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Regular Edition

VOL. LXXXVIII. NOVEMBER 11, 1905. No. 1559.

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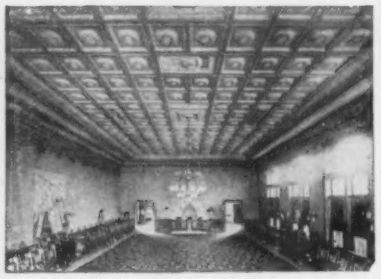

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SOCIETIES

COLORADO CHAPTER, A. I. A.

We, the Colorado Chapter of the American Institute of Architects, contemplate with pride, the life; and in genuine sorrow, the death of one of our most prominent members, Mr. Frank Eugene Kidder.

Mr. Kidder was born in Bangor, Me., on Nov. 3, 1859, and died at Denver, Col., Oct. 27, 1905, in the prime of his manhood, at a time when his life's labors were developing into fruitage, and there was a call for further service at his hands.

A graduate from Maine State College in 1879, whence he received the degrees of C.E. and Ph.D.; a student in architecture at Cornell University and the Massachusetts Institute of Technology, 1878-80; assistant in the office of Ware & Van Brunt, and prominent offices in New York City; experienced as a practising architect in Boston and Denver, he was well equipped to become the author of various text-books which are perhaps the crowning achievements of his professional life.

His *"Churches and Chapels," "Building Construction and Superintendence"* and *"Roof Trusses"* are valuable additions to the library of an architect, and every student and practitioner in building lines knows of *"Kidder's Architects' and Builders' Pocket Book."*

Mr. Kidder has been a practising architect and consulting engineering in Denver for seventeen years, and was highly thought of generally by the profession. He was an active member of the Colorado Chapter of the American Institute of Architects, and its president during the years 1903 and 1904, and an Honorable Fellow of the A. I. A.

He was a kindly Christian gentleman, and his good offices will be sadly missed in the immediate community in which he lived and labored. In sincere friendship and love, we inscribe upon the records of our Chapter these inadequate notes in his memory, and extend to his bereaved family our heartfelt sympathies.

W. E. Fisher,
President Colo. Chapter, A. A. I. A.
Attest:
William Cowe, Secy.

PERSONAL MENTION.

Beverly, Mass.—Mr. Charles Ely has given up his office here and entered the employ of a Boston firm.

Lincoln, Neb.—Mr. George Berlinghoff, of Beatrice, who is engaged on several large building contracts for the State, will remove from Beatrice to Lincoln, immediately.

St. Paul, Minn.—Mr. Clarence H. Johnston, architect, has brought a suit against Louis W. Hill to recover a balance of $600, alleged to be due for fees for building the defendant's Summit avenue house. The plaintiff alleges an agreement by which he was to be paid $2,600, and says that he has been paid $2,000. He demands the balance.

Baltimore, Md.—Messrs. Owens & Sisco, architects, who since the fire have been located at No. 14 W. Lexington street, will remove, on or about Nov. 15, to their former location at 1605 Continental Trust building, Baltimore, Md.

Philadelphia, Pa.—Mr. A. P. Valentine, Jr., of this city, for the past six years connected with the Government service at the United States Navy Yard, League Island, Pa., has resigned therefrom to accept the position of assistant structural engineer in the Bureau of Building Inspection, Philadelphia, Pa. This and other recent appointments in that Bureau have been made as the result of open competitive examinations conducted by the reorganized Civil

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GLOBE, ARIZ.—Mr. W. R. Norton, formerly of Phœnix, architect, has opened an office at Room 4, Oats & Wightman building. His plans for the new court house were accepted.

TRENTON, N. J.—Commencing Nov. 1, the new State Department of Charities and Corrections will take charge of the work of supervising the plans for all public school buildings in New Jersey, superseding Herman Kreitler, of Newark, architect for the State Board of Education. George E. Poole, Assistant Commissioner of Charities and Corrections, who is a licensed architect, will do the work after the date mentioned.

ST. LOUIS, MO.—A jury in Circuit Court rendered a verdict, Oct. 27, for $3,092.50 in favor of W. A. Cann against the rector, wardens and vestrymen of the Church of the Redeemer, Euclid and Washington Aves. The suit was brought by Cann, on May 16, to recover $4,329.50, alleged to be due him for having drawn plans and furnished estimates for a new church building. The contention was that after Cann and Henry Switzer had drawn plans for the new church, to cost $123,700, on which a percentage was to be paid, a cheaper building, designed by another architect, was determined upon.

SAN FRANCISCO, CAL.—Louis Theodore Levy, a French architect, with offices in New York, either fell or jumped from a window in McAllister St., Nov. 3, and was crushed to death on the cement sidewalk, 40 ft. below. Throughout last summer Levy was in San Francisco assisting D. H. Burham in plans for the beautification of the city.

DES MOINES, IA.—At the meeting of the library board, Oct. 28, the last payment to C. O. Smith for his services as architect was reported to the board. The last warrant called for $1,041.17. The contract price was for 5 per cent. on the entire building cost, including stationary expenses. Mr. Smith as survivor of the former firm has received a total of $13,000.

ST. PAUL, MINN.—Thirty-one architects from Chicago, composing the entire force of assistants and draughtsmen of the firm of Holabird, Roche & Renwick, passed judgment upon Minnesota's new Capitol building, Oct. 29, and declared it to be one of the greatest public buildings in the world. The party visited St. Paul at the expense of the firm, which is designing the Cook County court house and many other prominent buildings.

George H. Carsley, representative of Architect Cass Gilbert, acted as the host to the visitors and was assisted by Frank T. Hansen, secretary of the Capitol Commission, Thomas G. Holyoke and Fred Scott. The Chicago party was in charge of F. B. Long, head draughtsman for the architectural firm, although A. E. Renwick, of the firm, was also present.

"The most wonderful thing about the building," declared Mr. Long, "is its cost. The structure could not be duplicated today, with materials at prevailing prices, without costing at least $1,000,000 more than it has cost.

"We expected to see a magnificent building, but we must acknowledge that it far exceeds our expectations. To my mind it is the finest public building of its kind in the country. I do not see any chance for an improvement that I would recommend. The care and thoroughness with which the plans of construction have been followed, even to the minutest detail, makes it a building which the architect could study for weeks with profit to himself."

The visitors were entertained at dinner in the Capitol restaurant by Mr. Carsley. During the day the party inspected every portion of the building. They were particularly interested in the dome construction, and a considerable portion of the afternoon was spent in a study of that portion of the building.

This visit will undoubtedly lead to a general excursion from Chicago in the near future, to be participated in by the entire Illinois Chapter of the American Institute of Architects. The building so far exceeded the expectations of the out-of-town visitors that they declared they would urge

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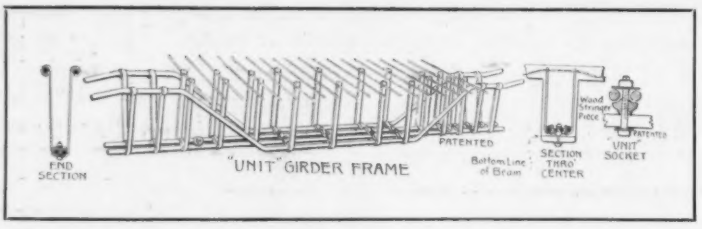

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all architects of Chicago to take part in another excursion to Minnesota.

Those in the party were E. A. Renwick, R. G. Holabird, M. A. Augur, F. M. Carroll, F. J. Thielbar, George Schell, T. W. Dentjer, G. Hammer, J. B. Blake, D. Fraser, G. E. Graves, W. A. McDougall, Harold C. Ferree, E. Roy Sholes, L. R. Broadhay, F. L. Sutherland, Swan Ingeman, C. F. Austin, O. D. Whittaker, Joseph D. Kopp, M. A. White, W. R. Smythe, W. J. Denigh, C. R. Percival, Charles B. Barnes, Irving G. King, K. A. Raltze, Joseph Ludgin, Paul V. Hyland, F. B. Long.

NOTES AND CLIPPINGS.

THE CHATEAU DE DAMPIERRE.

The Château de Dampierre, about twenty miles from Paris, which has been in the possession of the Ducs de Luyne for nearly three hundred years, is mentioned in records as far back as 1357 as being a manorial estate, and consists of a square building with two wings jutting out on either side, flanked at the extreme angle of each pavilion by small round towers and surrounded by a moat of running water. The red brick is picked out with white stone. The château is approached by an outer and an inner courtyard, separated from one another by a balustrade. At the back and at either side facing the beautiful gardens are broad terraces reached by flights of steps and lined by balustrades. The whole looks out onto gardens similar to those of Versailles and extensive woods, while opposite the left wing is a magnificent sheet of water, at whose furthermost end is an island with four little pavilions.

Volumes could be written about the hall, with its immense stone staircase, its galleries and its ancient frescos; about the salons, one of which is specially devoted to the memory of Louis XIII; to the chapel, to the gardens and to the park. But it is sufficient to say that Dampierre is one of the finest monuments of the genius of Mansart, the creator of the Palace of Versailles, of the Dome of the Invalides, and of the Place Vendôme. Louis XV. spent much of his time there, and his Polish consort, Queen Marie Leczinska, made no less than six prolonged stays at Dampierre. Mme. de Pompadour, the Mareschal d'Estrees, Colbert, the Duc de Saint Simon, author of the famous "memoirs"; the Cardinal de Lorraine, Louis XVI. and Queen Marie Antoinette and many other historic personages have been hospitably entertained at Dampierre, and, unlike so many French châteaux, it escaped all injury at the time of the great Revolution, owing to the Duc de Luynes of the day declining to emigrate along with the royal princes and the nobles, and to his remaining quietly at Dampierre throughout the whole of the Reign of Terror. He was wont to describe himself as "Citizen" Luynes, became a member of the Senate in 1843, and died during the reign of the Third Napoleon.

It is to his son that Dampierre is indebted for some of its finest statuary and pictures. He was a man of great erudition and a collector of art treasures, conspicuous among which are Ingres's celebrated masterpieces representing the Golden Age. He sacrificed a considerable part of his fortune for the cause of the Royalist pretender, the late Comte de Chambord, and, like his son and grandson, remained aloof from the Tuileries, for the duke, whose widow has just died at Dampierre, held a commission in the Papal Zouaves until the invasion of his native land and the fall of the empire caused him to place his sword at the disposal of France.—*Marquise de Fontenoy, in N. Y. Tribune.*

THE FIRE-RESISTANCE OF CONCRETE.

With the advent of reinforced concrete and its increasing popularity, says the *Builders' Journal*, the question of its fire-resistance, as well as that of the fire-resistance of ordinary concrete is being more closely considered than heretofore, and this consideration is certainly very necessary seeing how this matter has been previously neglected.

As a rule the architect will generalize and speak of "cement concrete," giving little heed to whether the requirements of the building necessitate coke-breeze concrete, slag concrete, Thames-ballast concrete or otherwise. Similarly, if the architect specifies a ferro-concrete floor, he appears to specify it in general terms or to the specification of some specialist contractor, and again gives little heed to what aggregate would be most serviceable to the requirements he has to meet.

In broad terms, cement concrete is generally described as fire-resisting, and reinforced concrete is similarly described. As a matter of fact, nothing is more dangerous to the safety of a building than reinforced concrete where the metal work is not suitably protected against the impingement of flame, and where the aggregate has not been selected so as to prevent its flaking off or disintegrating on the application of heat and water. For ordinary concrete work the question of aggregate is likewise of the utmost importance as far as fire-resistance is concerned.

On the concrete floors in Great Britain that have been tested and found satisfactory, the floor constructed on the Columbian fire-proofing system occupies a front place. This system of fire-resisting floor construction is for all practical purposes a reinforced cement-concrete one, the bars being carefully protected from the impingement of flame. In this system a suitable concrete aggregate has been used from the very outset of its introduction in this country. Expanded metal is also another system of reinforcing concrete which is highly esteemed. On the other hand, a Swiss reinforced cement-concrete floor that was put forward for independent investigation failed lamentably, the reason being that both an unsuitable concrete aggregate was used as also insufficient protection accorded to the bars, which were placed too close to the soffit.

As we go to press the most extensive investigations that have so far been undertaken anywhere upon this question will be in operation at the British Fire Prevention Committee's testing-station, where, on the one hand, the committee, in conjunction with the Associated Portland Cement Manufacturers, Ltd., are undertaking a test with seven variations of concrete aggregates as applied to floor bays, whilst, on the other hand, Messrs. Coignet, of Paris, have put forward a large floor, measuring 15 feet by 22 feet, in order to have the fire-resistance of their ferro-concrete system tested. As to the last-named investigation, it is of course too early to speak until the test has actually taken place, nor are details of the construction of the floor in question yet available, but as to the test with the concrete aggregates in general use we have some further particulars to hand giving data of what the concrete aggregates comprise, and as this is of general importance we think it is advisable at this juncture to present some particulars as to the construction of the floor in which these seven concrete varieties come under investigation.

If these investigations teach nothing else, they should serve as a warning against the promiscuous use of concrete aggregates that do not lend themselves to fire-resistance.

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The construction of the concrete floor may be described as follows:

The floor was divided into seven separate bays, each bay being, in the clear, 10 feet long by 2 feet 7 inches wide between the casing of the girders.

There were six girders of 6 inches by 4½ inches, weighing 20 pounds per foot linear, the ends being built into the side walls of the hut. Each girder was encased with coke-breeze concrete 8½ inches wide by 10½ inches deep, so as to give a minimum of 2 inches concrete all around the girder.

The bays or slabs of concrete were 5 inches thick, and were quite separate, resting on a 4½-inch set-off all around the hut and on the concrete casing of the girders.

The cement used was Portland cement supplied by the Associated Portland Cement Manufacturers, Ltd., London, and described by them as "Ferrocrete," used as a trade name for this particular brand of cement.

The following is a description of the aggregates, giving the amount of aggregate to 1 *part* by measure of cement in each case:

(1) *Furnace-Slag Concrete.*—Blast-furnace slag from the Islip Iron Works, Thrapston, Northampton, broken to pass a 1½-in. ring, 3 *parts*. Clean pit sand from Kent, 2 *parts*.

(2) *Broken Brick Concrete.*—Broken brick to pass a 1½-in. ring, 3 *parts*. Clean pit sand from Kent, 2 *parts*.

(3) *Broken Granite Concrete.*—Broken granite, ¾-in. Guernsey granite chips, 3 *parts*. Clean pit sand from Kent, 2 *parts*.

(4) *Burnt Ballast Concrete.*—Burnt ballast, viz., clay from the neighborhood of Child's Hill, burned with slack coal, broken to pass a 1½-in. ring, 5 *parts*.

(5) *Coke-Breeze Concrete.*—Coke-breeze broken to pass a 1½-in. ring (free from fine dust), from the retorts of a London gas company, 5 *parts*.

(6) *Clinker Concrete.*—Furnace clinker, viz., the raking from the furnaces of large boilers, broken as last, 3 *parts*. Clean pit sand from Kent, 2 *parts*.

(7) *Thames-Ballast Concrete.*—Thames ballast dredged from the River Thames to pass a 1½-in. ring, 3 *parts*. Clean pit sand from Kent, 2 *parts*.

In each case the material was turned both in its dry and wet condition, and the concrete to form each slab laid on the centering in a rather wet state, six pails of water being used for each bay, slips of wood being fixed at the sides to retain the concrete in its place and form the necessary spaces.

THE CHÂTEAU D'AZAY-LE-RIDEAU.

Mr. Richard Sudbury, in his "*Two Gentlemen in Touraine*," has a most delightful chapter on Azay-le-Rideau.

"The château," he says, "rises out of the bed of the river in the shape of the letter L. It is built around two sides of a square, each end being flanked by two round towers, which arise in graceful proportions; the four spires of their pointed roofs strike the sky in perfect symmetry. The wing on the right, with its two towers, is mirrored in the unruffled waters of a moat, and seems almost to be without a beginning and without an end. We cross a wooden bridge, in order to reach the courtyard, and there study the architecture of the château in detail. The bridge is hung with creepers of all kinds, twining around the beams and pillars, and falling toward the river in long garlands. Beneath it still runs the Indre, silent and swift and dark, although here it is but a tiny stream, turned and twisted long since to encircle the château and to beautify its park.

"The most striking feature of the principal façade is the motif of the grand staircase, which rises to the high roof and which ends in an architectural performance of such grace in detail and of such beauty of ensemble that it reminds us of Oxford in England.

"Unlike the Château de Blois, the staircase here is not an exterior one; it is not open, nor is it circular. But though it is flat in appearance and lacking in that wonderful vitality which seems to give to the staircase of Blois its greatest charm, this one at Azay-le-Rideau rivals it in delicacy of carving, in the perfection of its lines, and in the softening shades which give to it both poetry and romance. A series of windows, one above the other, beneath which are the two doors opening upon the court, forms the backbone of the architectural motif, as well in other portions of the château as here. The unity with which they are devloped into a climax at the central point is perhaps the true secret of the wonderful beauty of Azay. In other châteaux of the Renaissance or of the Mediæval period, there is perhaps one corner, one wing, to call forth praise or criticism. We find a fraction of detail, an historical point, a portion of the whole; but here, as in no other, do we see a complete ensemble, an entire château as it should be.

"Tiny figures stand out in relief from ornamented pilasters, or from columns supporting canopial niches. Above the doors,

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we see again—it seems more delicately carved than ever before—the salamander of François beside the ermine of Brittany. Ornaments of every kind surround them and rise around the windows to the castle's roof. The artist seems fairly to have exhausted the delicacy of his chisel as well as the fancies of his imagination.

"The towers on the left are smaller than those upon the right, and they are terminated in what are known in France as 'culs de lampes.' Three sharply outlined mouldings divide the walls at each story, and the heavy cornices above, in imitation of the 'machicoulis' of the Mediæval château, run round the edges of the roof like a massive chain. They are broken, here and there, by the heavy windows of the roof, which show in relief against the dark and rusted slates. Although the court below is barren of the orange trees that the eye has learned to expect in so many of the Renaissance châteaux, it is hardly noticeable here. For there is everywhere that charm which is to be found in places where a true artist has assisted nature to fulfil her task, and where the result would seem to have been fashioned by a fairy's hand. There is nothing to offend the eye. Colors and shades are in harmony one with another. The flowers are of quaint origin, and are those more often to be found in old-fashioned gardens. The parterres and shrubberies are those of a century ago. There is nothing here in tinselled gold, or in a new frame. All is in soft taste. There is neither the overpowering wealth nor the show and the glitter which we find in some places. Here everything is covered with a cloak of mellowness and harmony which time alone has the power to cast over it. There is something which speaks unmistakably of distinction and refinement, something which would never shine too brightly nor be surrounded by too much wealth. Indeed, we might say in conclusion as we gaze at the whole: 'Here is something at last which is more than beautiful. Here is something which is almost perfection.'

"As we cross the threshold of one of the carved oak doors, the staircase appears before us in all its magnificence. It is the chef d'œuvre of all the Italian staircases of this epoch. It is better, even, than those of Cour-Cheverny and of Chenonceau. These staircases, of which the three mentioned are the best examples, were a novelty in the sixteenth century. They were brought from Italy to take the place of the circular staircases which preceded them. The carving of this at Azay-le-Rideau is especially worthy of our notice. Flowers, fruits, statues, animals, monograms and heraldic emblems are placed everywhere, with a perfect genius of taste in their arrangement.

"A butler ushers us into a dining-hall, where the walls are hung with many interesting paintings. These paintings form but a small portion of a large collection. There are in all six hundred and fifty pictures. Two hundred and fifty of these are originals, while the remaining four hundred are good copies. The room is paved in black and white marble, and a great sideboard bearing the name of Jean Goujon almost covers one side of the apartment.

"We wander on from one apartment to another, all filled with old furniture of great value—the bed-chambers with their massive four-posted beds, the salons with their pictures and here and there a stone chimney that reminds us of Blois or Chaumont, follow one another in successive interest. We forget, indeed, a faded curtain or a piece of threadbare carpet—the only signs of imperfection in the château—in the beauty of their surroundings; the only feeling which survives is one of harmony and refinement.

"Azay-le-Rideau, more, perhaps, than any other château of Touraine or its surrounding country, brings to us the life and the atmosphere of bygone days, which still linger through the present century. And with it all there is so much poetry and romance lurking about the architecture, filled with the Italian influence and its surroundings, less perfect than the château itself but still full of charm, that our fancy is drawn to it irresistibly."

Our Unmarked Churches.—"One of the greatest difficulties I encountered in seeing New York," complained the visitor, "is the lack of signs on your churches. I notice a beautiful church, and, of course, want to know what it is. A little tin sign on the side seems a help, but when I consult it I learn only the name of the undertaker. Why should the church advertise him to the tourist, instead of stating its own name and denomination? This having an undertaker thrust on you when you are out sightseeing is something of a shock."—*New York Sun.*

Pulp Refuse as Fuel.—From the refuse of paper-pulp mills an Indiana glass-worker has invented a new fuel which is said to possess more heat units per pound than

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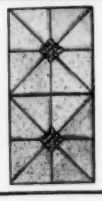

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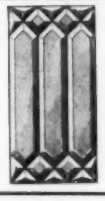

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either coal or wood, and which can be manufactured and sold at a profit at one-half the cost of coal. The refuse, a combination of soda and lime, is mixed with crude oil until the finished product has a consistency of putty, being manufactured much as a plasterer makes mortar. In this state it may be cut with a spade and thrown into the furnace or beneath the boiler, no kindling being necessary, as the material ignites readily from the flame of a match, and burns with an intense heat and without smoke, except when under a strong draught. Its success as a fuel for domestic purposes was determined some time ago, but not until recently, when it was used beneath an engine boiler, has its value for manufacturing purposes been demonstrated. In this test a bushel-basketful of the fuel beneath a sixteen horse-power boiler kept steam up for eight hours, no clinkers and little ash remaining after the fire had burned down. Aside from the possibility of a cheaper fuel, the invention is of importance in converting the thousands of tons of refuse which every pulp-mill in the country turns out annually into a valuable by-product.—*Clayworker.*

Labor Conditions in New York.—According to the September *Bulletin* just issued by the State Labor Department, there are fewer idle wage-earners in New York than there were even in 1902, the most prosperous of the last ten years. During the first half of this year, the average monthly number of unemployed members of trade unions, embracing 100,000 members, was only 151 per 1,000, as compared with 262 last year and 168 in 1902. These conditions grew better as the summer advanced, when labor disputes almost ceased to affect industrial operations. In the months of April, May and June work was begun on 7,316 buildings in New York City, as compared with 5,164 a year ago. The number of buildings completed in the second quarter of the present year was 4,673, as compared with 3,455. These figures, however, fail to convey an adequate idea of the extent of the building operations now going on in the metropolis. The estimated cost of projected buildings for which plans were approved and permits issued in the second quarter of 1905 attained the sum of $78,417,896. As a matter of fact, the cost of buildings projected in the first six months of the year exceeds the cost of those projected in the entire twelve months of 1902 or 1903.—*N. Y. Evening Post.*

Edinburgh's Water-Supply. — Consul Fleming, of Edinburgh, Scotland, reports the completion of a new reservoir, which increases the water-supply of that city by 9,655,000 gallons per day. The construction of this reservoir involved great engineering difficulties, and occupied ten years. He writes:

"When, about fifteen years ago, the inadequacy of the water supply of Edinburgh became apparent, it was resolved to construct a large reservoir in the valley of the Talla River (one of the headwaters of the Tweed), 35 miles south of Edinburgh, where the gathering ground amounts to 6,180 acres, or about ten square miles. Work was begun on this water scheme ten years ago, and it is now completed. The new reservoir has a water surface of 297 acres and a storage capacity of 2,750,000,000 gallons. The embankment thrown across the valley from hill to hill to dam this flood is 1,300 ft. in length and 90 ft. high from the river bed level, having a base of 600 ft. in breadth and tapering upward to 20 ft. at the top. The high-water level in the reservoir is 950 ft. above sea level.

"To carry off the river and flood waters during the construction a tunnel 400 yards long was driven through hard rock in the hillside near one end of the embankment, and subsequently was lined with brick. In this tunnel there have now been laid the pipes which take the water to the measuring house farther down the valley. A 36-in. pipe, which carries the compensation water to the stream is laid on the bottom of this tunnel. There are three levels at which water may be drawn off for Edinburgh, each controlled by a 24-in. valve, worked by hydraulic power, and the necessary shafts are situated along the line of the discharge tunnel. The waste weir, 200 ft. in length, built of solid masonry, is capable of passing large floods. The length of pipe track between the measuring house and the filters (near the city) is more than 35 miles. It includes nine miles of tunnel and 12 miles of what are known as cut and cover aqueducts, the remainder being bridges and cast-iron piping. There are altogether 21 tunnels, the longest of which is 1⅛ miles, and the shortest 133 yards. Cast-iron pipes are used for the syphons across valleys. For the benefit of future generations the engineers recommended that the new aqueducts should be made to carry, not 10,000,000 gallons a day (which would be sufficient at present and for many years), but 20,000,000, and that was accordingly done. For the conveyance of material to the reservoir while under construction, a railway nine miles long was built, at a cost of £64,957 ($316,113.24).

"It is estimated that this reservoir will add at least 9,655,000 gallons per day to the Edinburgh and district water-supply, bringing it up to 25,000,000 gallons per day, equal to 55 gallons per head per day to a population of 455,000. The first estimate of the total cost of the Talla water scheme was £750,000 ($3,649,875). The expenditures actually incurred amounted to £1,143,290 ($5,563,820.79). The cost has been met by issues of water trust bonds, redeemable by means of a sinking fund provided for out of the water rates."

The Breathing Wells of Nebraska.—The United States Geological Survey for some time past has been making an investigation of curious phenomena known as "blowing" or "breathing" wells. These wells occur at various places throughout the country and have been the subject of considerable scientific investigation. In the course of collecting well records, the hydrologists of the Survey have observed many wells that emit currents of air with more or less force, sometimes accompanied by a whistling sound which can be heard for a long distance. The best-known examples of this type of well are found throughout the State of Nebraska. Blowing wells

Continued on page xi.

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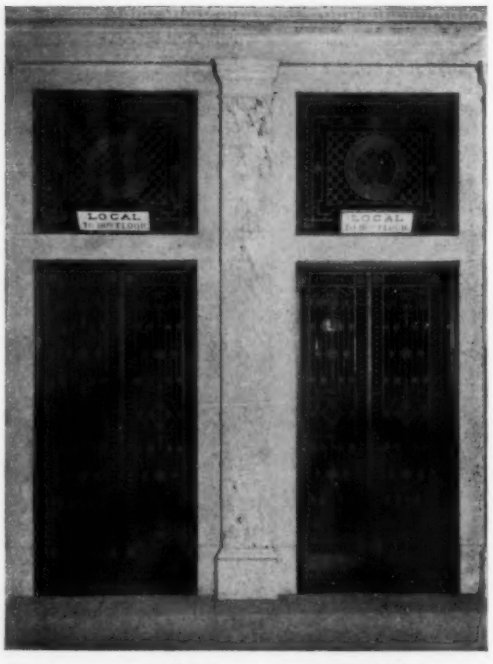

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SOCIETIES, PERSONAL MENTION, ETC. IV

THE bad leaven sown by the Cleveland architects—if leaven can be sown—is, we regret to say, working. Through the process of inoculation the virus, however, takes on a more beneficent character in Louisville, Ky., than it had in Cleveland. In the Kentucky metropolis, in place of the architects sounding their own trumpets, it is the Building Contractors' Association who have just passed a resolution—self-suggested and uninstigated, we hope—"respectfully urging those who contemplate building to avail themselves of the services of Louisville architects." The grounds for this request are found in the Association's stated belief that Louisville architects "occupy a position with regard to competency second to none in this country." As a voluntary expression of opinion this may be very pleasant; but we think the incident regrettable. Although it does not reduce Louisville architects to trade-union membership as the Cleveland architects were reduced by their own voluntary action, it does not exactly add anything to their dignity of professional standing.

WE hope that the St. Louis Chapter, A. I. A., has not been influenced by the motives assigned to it by the newspapers in voting not to take part in the proposed competition for the Roman Catholic Cathedral to be erected in that city, at a cost of a million dollars or so. The ostensible reason is that no prizes are offered and that the compensation to be paid the successful architect is wholly inadequate. Behind this is said to be a feeling of irritation because Archbishop Glennon has manifested a certain distrust of "home talent" by inviting certain French, German and Italian architects to compete, extending the invitations personally during a recent trip abroad. The duty that the profession owes to the public is a greater and higher one than that which it owes to itself. Just as the Boston Society of Architects, in voting not to enter the competitions for the Suffolk County Court-house and for the State-house Annex, and the Philadelphia Chapter, A. I. A., in refusing to have anything to do with the Pennsylvania State-house competition, were guilty of lapses from good citizenship, so it seems possible that the St. Louis architects may be now taking a step that may lead to lasting regret on their own part and that of their fellow-citizens.

THE Grand Jury for Cook County, Ill., has just returned an indictment against one Frank Koenig, a contractor, who is charged with practising as an architect without a license, in disregard of the Illinois Architects' License Law. If we are right in thinking that this is the first suit of the kind, we hope that Mr. Koenig has money or backing enough to fight the case through the courts. We believe the constitutionality of this law has never been passed upon, and the fact that courts in other States have declared similar license laws as affecting other trades unconstitutional makes it desirable that the constitutionality of license laws as applied to architects should be passed on.

ONE of the most curious appeals, from Philip drunk to Philip sober, has just been made by Signor Ernesto Biondi, who cannot swallow his defeat in the "Saturnalia" lawsuit against the Metropolitan Museum of Art and now, seemingly, feels sure he has found the way at last to make the matter a real "international incident." It was only some six weeks ago that the New York Supreme Court decided that the sculptor had no case against the trustees of the Museum, and now he lodges with the Secretary of State, with the assurance that he will accept his decision as final, a plea that he shall act as arbiter in the matter, thus saving him the cost of pursuing his suit through the higher courts. The significance of his appeal lies in the fact that the present Secretary of State, Mr. Root, was, and, it seems, still is, one of the trustees of the Museum against whom the sculptor unavailingly brought suit. Signor Biondi feels that Mr. Root, because of the position he now fills, can no longer be influenced by sordid regard for the pockets of himself and his co-trustees but can afford to take a more ethical, or, perhaps, a more eleemosynary, view of his contention. Mr. Root, however, has declined to serve.

FOR several weeks we have watched daily the interesting operations involved in moving a brick building in the grounds of Columbia University, but, interesting as they are, they are as nothing in comparison with similar operations going on at the same time in Jefferson Avenue, Brooklyn. In the first case, the building is a two-story brick building, reasonably well built, essentially a Greek cross in plan and about fifty feet square. This building has to be raised and moved backwards, and a little to the left, about one hundred and fifty feet and set upon new foundations. The interesting features here are, first, that the building does not move along two sides of a triangle, but in an irregular way along the hypothenuse, and secondly that no rollers are used, the building being made to slide along

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well-greased ways or tracks. In the Brooklyn case, a block consisting of five three-story brick and stone houses, built at different times by different builders and, so, in no sense homogenous, is being raised and transferred to the opposite side of the avenue, to a site some little distance below the original one. Here the interesting and very extraordinary feature is that, during the process of moving, this huge mass, weighing some five hundred tons, is to be turned half around, so that the fronts of the buildings may once more face upon the street, but with a diametrically opposite aspect. In this case the operations, which promise to be successfully carried out, are expedited and facilitated by the use of rollers, as usual. In both cases the movers were so sure of themselves that they didn't take the trouble to remove the glass windows and tenants were assured they could remain in and use the premises in entire safety.

THOSE who saw the Boston Fire of 1872 will never forget one picturesque element there that has attended no other great fire, for, owing to the "hippozoötic" which at that time placed practically every horse in Boston and its neighborhood upon the sick-list, the fire-apparatus had to be drawn to the fire by men, or oxen, aided now and then by a light carriage-horse from some private stable. The Chief of the Fire-department at that time was John S. Damrell, who died last week, and he handled the fire, probably, as well as any one could have, and, when a few years later he retired, it was felt that his knowledge of the action of fire upon buildings peculiarly fitted him for the post of Inspector of Buildings, and accordingly he was appointed to that post and filled the position for some twenty-five years. His early experience, during more than a score of years, as a builder, added to his qualifications, and for many years his conduct of his office gave general satisfaction; but, latterly, when architects were beginning to introduce improved methods of construction, his "rulings" were found to be not a little obstructive and more than one quiet attempt to bring about his resignation was made by them. But the service he had rendered to the city was so unquestionable and his good intentions were so apparent, that these attempts had no fruition. But, at length, a few years ago, he was removed by Mayor Collins because, we believe, of the corruption that was alleged to exist in his bureau. Captain Damrell attempted to stem the Boston conflagration by blowing up a large number of buildings, for the value of which the owners thereof endeavored to hold him personally responsible, since, besides being fire-chief, he was at that time partner in a firm of builders upon whose contracts an attempt to levy could be made.

IN connection with Captain Damrell's death, it is well to chronicle that of another famous fire fighter, Mr. Frederic Grinnell, who, however, fought with his wits rather than with his hands. The fire losses saved to the textile manufacturers alone of this country through the invention and enforced adoption of the automatic sprinkler is simply incalculable, and, as every fire is the potential focus of a conflagration, the money saved to the people at large is still more vast. The Parmelee sprinkler, invented in 1874, was not a practicable apparatus until Mr. Frederic Grinnell took hold of it and made such improvements and changes that the Boston Manufacturers' Mutual Fire Insurance Company and its allies saw it was worth while to make the introduction of the Grinnell sprinkler obligatory upon their members. From that time, 1881, Mr. Grinnell began to build up a large and very profitable business, which has been of very great value to the country.

AT the recent annual convention of the Massachusetts State Firemen's Association, William T. Cheswell, Chief of the Boston Fire-department, read a paper on the danger to life from fires occurring in crowded stores—a topic to which we have more than once referred with much anxiety. In addition to well-known recommendations relating to limitation of space between fire-walls, brick-enclosed staircases and fireproof elevator shafts, Mr. Cheswell lays particular stress on the planning and placing of stairways in the positions that they would most naturally be expected to be found, and the importance of the fact that the foot of one flight should conduct naturally to the head of the next lower one. He also condemns the use of the revolving door and calls attention to the fact that storekeepers, who wish to display large stocks, do not provide in the passages between counters and showcases a sufficient and reasonable amount of space. Here is a matter which it seems to us should be regulated by ordinance, even though it would in a manner interfere with individual liberty of action and the right of use of private property. These great modern temples of trade should be in every detail as much subject to public control as are theatres, factories and churches.

WHETHER intended for one purpose or another—for elevator service, for automatic-sprinkler service or for general fire-service, a glance from the top-story of a high building in any city will show that there are, all through the business section of the town, a large number of water-tanks, of many makes and more sizes, perched precariously on roofs and walls, ready to do large damage if not properly cared for. The Boston Manufacturers' Mutual Insurance Company has been insistent in instructing its members as to the kinds of defects this useful receptacle is heir to; but though the impossibility of protecting the hoops from rusting on the inner surface and the probability of the rotting of wooden staves have often been pointed out, we do not recall that any recommendation has been made that the slender steel framework upon which many of these tanks are reared should be protected with fireproof material. At many a fire, a fall of roof and floor has been caused by the fall of a roof tank, whether full or empty, and it is easy to see that a flame playing for a very short time on the slender framework would cause it to crumple up under the weight and let the tank fall upon and through roof and floors. A law that should oblige roof tanks to be encased in and supported by masonry would in time, perhaps, give to our cities something of a mediæval air, and might do much to banish the terrible monotony of the present sky-line.

THE TOWER AND SPIRE OF ST. NICHOLAS'S CATHEDRAL, NEWCASTLE-ON-TYNE.[1]—I.

WE are all, I am sure, admirers of the beautiful steeple of St. Nicholas's, which, from so many points of view, crowns the city of Newcastle. Many, no doubt, have sketched it, but as probably few have made measured drawings of it, those I am about to show will, I hope, be interesting. A measured drawing is often a surprise to those who have only made mental records or perspective sketches. I have read of an over-zealous restorer who, when remonstrated with for his suggested destruction of an old church tower in order to replace it with something more "mediæval," replied: "Yes, I admit that the tower looks all right, but if you will step into my office I will show you a measured drawing of it, and you will see what an absurd thing it really is!" I do not, of course, mean that you will find the steeple of St. Nicholas's absurd in elevational drawings, but you will probably find that the contours and general proportions appear different from your expectations.

It might not be out of place here to suggest that drawings of the "artistic draughtsman" type were not used by the old masters of our profession, either Mediæval or Renaissance, who were content with little more than diagrams and rough sketches; while models were much more used than now for judging of the ultimate effect of the work—a practice much employed by Sir Christopher Wren and the late William Burges.

One peculiarity about this steeple is the liability of the Corporation for its repairs; this has been so ever since its erection, and when the last repairs were done in 1895 they were carried out at the expense of the Corporation of Newcastle by our firm. The same is the case at Antwerp, where the northwest tower of the Cathedral is entirely under the control of the Corporation of the city, and all expenses connected with the up-keep of the tower come out of the town revenue.

This gives the corporation the control of the bells, and at St. Nicholas's the corporation can have them rung at any time, so long as it does not interfere with Divine service.

Of course, the primary reason for the existence of a church tower is to hold bells; and we must remember that bells played a very important part in the Middle Ages, being rung not only for the calling of worshipers to the church and on occasions of public rejoicing and festivals, for the summoning of guilds, as the freemen of Newcastle are to this day, but also in case of alarm to call the citizens to defend the walls against assailants, to dispel tempests, to drive away evil spirits, to avert plague and pestilence, while the tolling of the passing-bell besought the hearers to pray for some fellow-Christian at that moment passing from this life into the intermediate state, and the solemn note of the "death-bell" gave warning that all that was mortal of the departed was being carried to its last home.

In Newcastle the town-watch used to muster in the lower part of the tower, which must have been screened off from the rest of the church. Here they received their orders for the night, and a picturesque sight they must have presented as they each emerged from the doorway of the tower, carrying bills and lighted lanterns, and proceeded to their several posts.

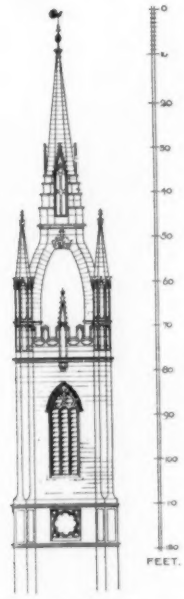
As for the adoption of this particular form of steeple, tradition says that it was erected in this manner, so that a lighted lantern could be suspended in it to guide wayfarers across the moor at night. Sykes says that it was "illuminated antiently for the conduct of travelers." There is a record of payment made in 1566 by the Mayor of Newcastle and his brethren "for four pounds of wax made in candle for the lantern of St. Nicholas's Church, and for the working three shillings, and for two pounds of wax wrought in candle for the lantern of St. Nicholas's Church eighteen pence." We know that this was the custom in other places. According to Stowe, the steeple of old Bow Church, London, was "antiently illuminated for the conduct of travelers at night." Anyhow, for whatever purpose erected, there can be no doubt that the steeple of St. Nicholas's is a most striking object, and certainly is the feature of the building.

This steeple is of the type called the "Scottish Crown," and is, with the exception of St. Nicholas's and St. Dunstan-in-theEast at London, only found across the Border—the two well-known examples being St. Giles's, at Edinburgh, and King's College, Aberdeen. There was one at Linlithgow, but it is now destroyed. None of these, however, at all equals St. Nicholas's in grace of outline, both the Scottish examples appearing heavy and lumpy in comparison.

To take St. Giles's first. The tower itself is a plain rectangle without any buttresses, and with three single-light belfry windows on each face. The crown consisted of eight arches springing from buttresses rising from the cornice of the tower, one at each angle and one in the centre of each face, one of these latter being enlarged to form a stair turret. These buttresses terminate in small, ill-proportioned pinnacles. The back of each arch, ornamented with a cresting, is a straight, raking line forming an abrupt angle with the buttress, and giving the idea of thrust. The lantern carried by these eight arches is merely a pinnacle surrounded by eight smaller pinnacles at its base. The parapet of the tower is very elegant, and consists of a row of pierced quatrefoiled circles surmounted by a cresting of the same design as used on the backs of the arches. The author of a book entitled "*A Journey through Scotland*," published in 1732, speaking of St. Giles's, Edinburgh, says: "Atop of this church is erected a large, open cupola in the shape of an imperial crown. King David erected a copy after this over St. Nicholas's Church, Newcastle, but it does not near come up to it."

In the Aberdeen example the crown consists of four arches springing from the angles of the square boldly buttressed tower, and supported, as in the case of St. Giles's, by stumpy buttresses rising from the cornice and terminating in small pinnacles. In this case, too, the backs of the arches are straight, ornamented

KING'S COLLEGE, OLD ABERDEEN.



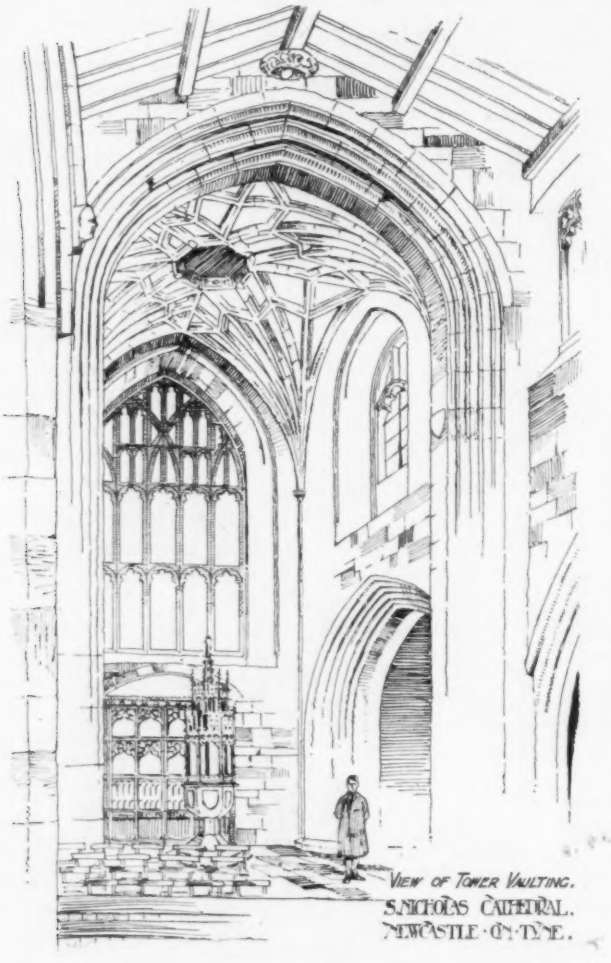
ST. DUNSTAN-IN-THE-EAST: STEEPLE.

ST. GILES'S CATHEDRAL, EDINBURGH.

[1] A paper by W. H. Wood, read before the Northern Architectural Association, February, 1905.

with a cresting, and having a pinnacle placed half-way up the slope. The lantern is solid and larger than that of St. Giles's, and finishes with an arched royal crown surmounted by an orb and cross. St Dunstan-in-the-East, designed by Sir Christopher Wren, is a small structure, but elegant. The four arches spring from the corners of the tower; they are unmoulded and of high pitch, the extrados being carried up by a reversed curve to the lantern, which is better proportioned than in the Scotch examples, and surmounted by a spire. Four pinnacles of good outline stand against the arches, into which they are bonded, thus giving a good mass of masonry where required to resist the thrust.

We will now proceed to examine St. Nicholas's. The tower stands at the west end of the nave, with which it communicates by a lofty four-centred arch, moulded with a series of splayed orders, each having a deep hollow sunk in the splay. These orders are continuous on jamb and arch without the intervention of an impost. The side arches opening into the aisles are similar but



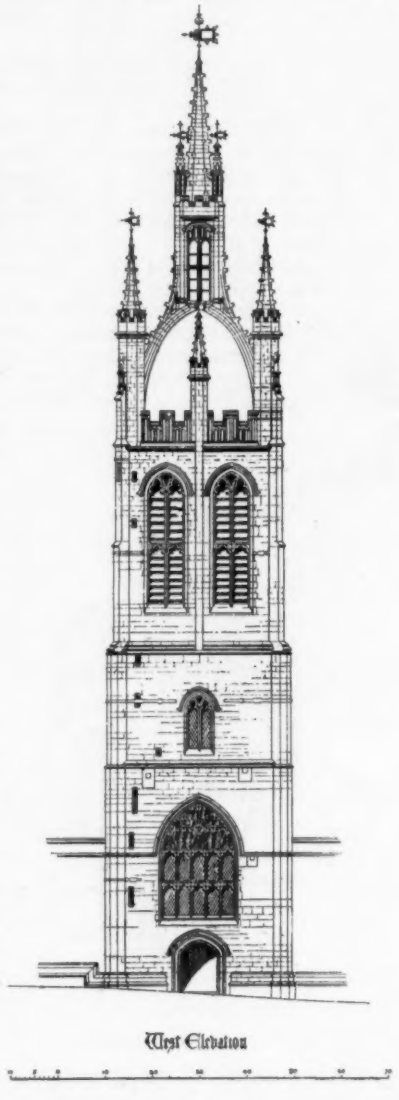
View of Tower Vaulting.
S. Nicholas Cathedral.
Newcastle-on-Tyne.

much lower, and with a three-light window over each. The mouldings of these and the arch to the nave stop on a boldly moulded plinth, which is unbroken except where the base of the vaulting shaft penetrates it. This omission of the cap is found in the fourteenth-century nave arcade, and in the nave arcade of St. John's Church, Newcastle; but in these cases the orders of the arch die into the sides of the octagonal piers at the springing line, and are not carried down to the base.

The west side of the tower is occupied by the doorway having a depressed four-centred arch, and with a five-light transomed window over it. In each angle is a small quarter octagonal shaft, from the cap of which spring the ribs of the vaulting. This is a lierne vault of beautiful design, all the ribs being of the same size and section, a splay with deep hollow, the same as to the arches below. Shields with the arms of the founder (three annulets, two and one, in chief a greyhound courant) are placed at the four points where the main ribs abut upon the octagonal well-hole, the other four points being occupied by carved bosses. Carved round the inner side of the well-hole is the inscription: "Orate pro anima Roberti de Rodes." Robert Rhodes, who lived in Newcastle from 1427 till 1445, and died in 1474, was a great benefactor to the Newcastle churches; and tradition has always credited him with the erection of this tower, probably somewhere about the year 1470.

The plan of the tower is, approximately, square, but owing to some irregularity in the setting-out of the east is narrower than the others, so that none of the corners are truly right angles. The spiral stair leading to the roof is in the northwest corner and does not show externally. The entrance to it is in the north jamb of the west doorway.

The staging of the tower is good, although unusual in this part of the country, the belfry stage being tall in proportion to the rest. Well-marked horizontal members coincide with the internal divisions, the first being a heavy string at the level of the ringing-chamber floor, and the second, which is formed of three courses of offsets, at that of the belfry. Staging, or the marking of the horizontal divisions of towers, is an art in itself. Many simple but very dignified towers owe their success to skilful staging. Take St. Margaret's at Durham, for instance, a simple square tower without buttresses or ornamental features, but divided into stories by bold offsets in such a way as to produce a most satisfactory effect.



West Elevation

To return to St. Nicholas's. The angle buttresses are semi-octagonal up to the bottom of the belfry stage, where they are weathered back, and somewhat abruptly change to square, set diagonally, and in this form are carried half-way up the four large angle pinnacles, where they terminate in pedestals, each supporting a life-sized figure, representing Eve, at the northeast corner, Adam, with the apple, at the northwest, Aaron with mitre and book, at the southwest, and David with the harp, at the southeast. These statues are very rude as works of art, and are now considerably weather-worn.

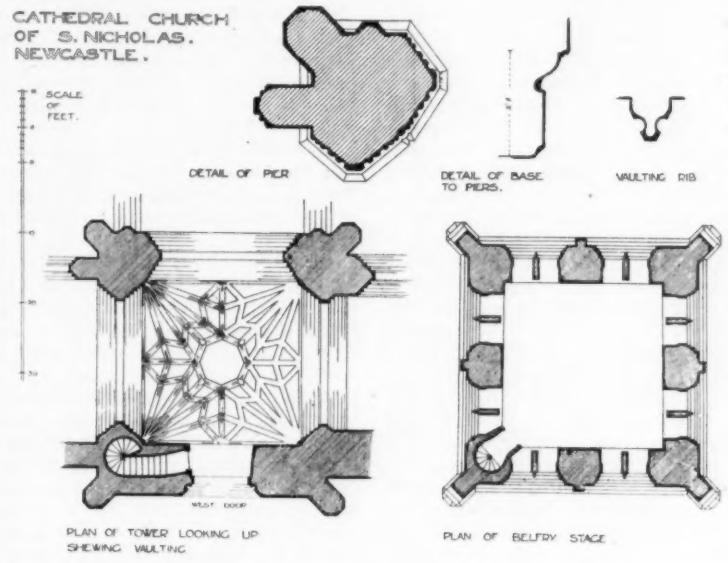
From the offset at the belfry stage there rise smaller square buttresses on the centre of each face of the tower. These are carried up through the cornice and merge into the face of hexagonal pinnacles, between which and those at the angle is a pierced battlemented parapet. This has been entirely renewed, and suggests in design the similar finish to the two stages of the central tower of Durham, which latter were entirely renewed about 1859, replacing those of about 1474.

The angle pinnacles are octagonal, 5 feet 9 inches in diameter, and 43 feet high above the cornice of the tower. They are beautifully designed, the height of the battlemented parapet being well-proportioned to the rest, and, as you will notice, the sloping sides of the upper portion curve out at the base with the most graceful effect.

There is a peculiarity in the arrangement of the crockets, which are placed on four angles only of these octagons, while in the smaller hexagonal pinnacles they are placed on every angle, but at

alternating levels, and this arrangement is adopted on the spire itself.

Internally, corbelled squinches are formed in each corner of the tower, but do not carry anything, as the angle pinnacles scarcely overhang the line of the inner wall face, but they help to bind the angle of the tower. From the inner faces of these angle pinnacles spring the great arches carrying the lantern and spire. These are 31 feet in span, and, as you will see from the section, are four-centred, but with the largest curve of 23 feet radius at the bottom, and the smaller curve of 14 feet 6 inches radius at the top, the intersection of the curves being exactly at two-thirds of the distance from the springing to the apex, where the arches meet on a key block. Through this block there is a hole 4 inches by 3 inches, probably for dropping a plumb-line during the erection of the spire, and it may have been used for suspending a pulley for hanging the light from at night. It seems hardly likely that the light would be placed in the lantern itself, as it is difficult to see how this could have been accomplished except by a man going up a ladder to do it—anything but a pleasant task on a stormy night—and if it were placed there the stonework would hide the light from any one approaching towards the angle.



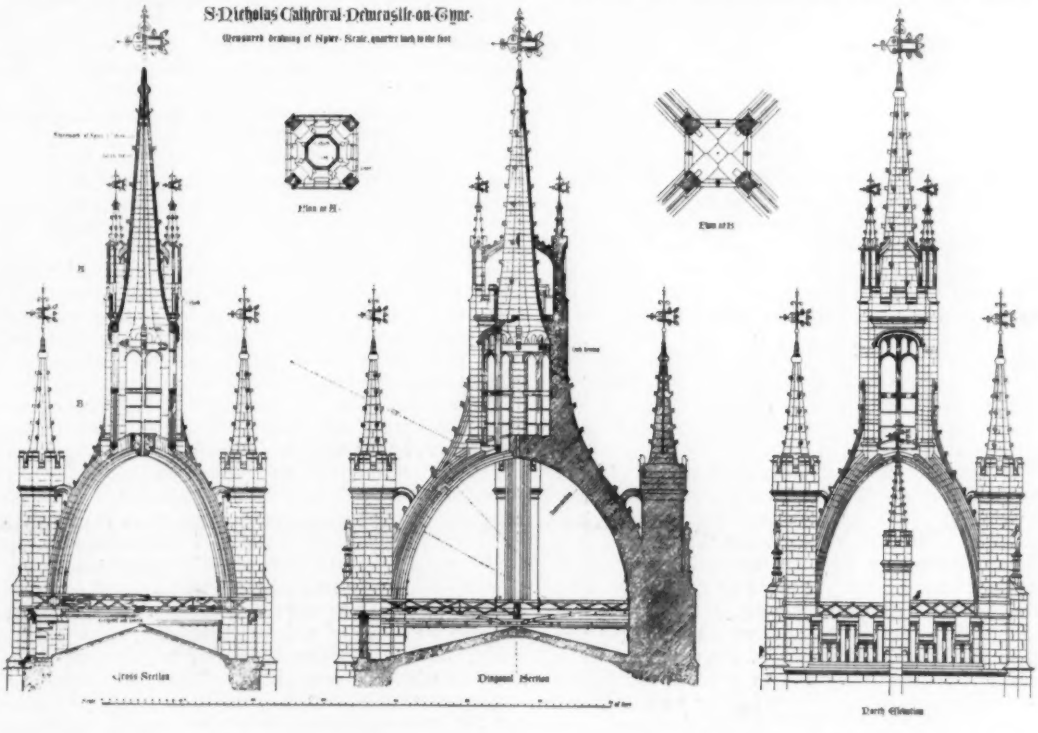
The section of the arches is built up of four orders, the upper one, which is crocketed, being carried in an ogee curve half-way up the angle buttresses of the lantern, which is thus much stiffened, and the arches themselves rendered more rigid, while a wonderful grace of outline is given to the whole composition, this feature being one of the chief causes of the superior elegance of this over the other examples. The courses of these ogee curves are laid with beds none of which radiate to the center, but are approximately horizontal for the lower half, and truly so for the upper, where they are bonded in with the angles of the lantern.

There is a popular belief that there is an iron core bar in the arches, but this is a fallacy; they are stone throughout.

The structure of the lantern itself is singularly light, and consists of four angle buttresses set diagonally, between which are two light-transomed windows, the mullions being carried on arched sills spanning from arch to arch. The lights of these windows are now filled in with strong bronze frames, inserted when the steeple was repaired in 1895, in place of the iron saddle-bars, which had rusted and split the stonework.

At the springing of these window-heads, from which point the spire commences (see section), are two oak beams 12 inches by 6 inches, placed crosswise and fastened to each angle of the structure by iron straps. The angle buttresses terminate in pinnacles with panelled sides, from which spring small flying-buttresses to the sides of the spire, which has the same graceful spreading curve at the base as have the angle pinnacles.

These concave lines are characteristic of the fifteenth century—you find them at Sedgefield on the pinnacles of the tower—and mark the greater appreciation of line which distinguishes work of this date from that of earlier periods. The masonry of the spire is laid with horizontal beds, and is 4½ inches thick, with the exception of the upper 7 feet, which is solid. The rod of the vane is brought through this solid portion, and attached to it is a rod with a weight at its lower end which hangs a few inches above the cross-beams and is supposed to act as a counterbalance to the spire during storms. This method has been adopted in other instances, but I am not sure that it is so good as securing the rod to the cross-beams would have been, or forking it and building the ends into the masonry, as Wren did at St. Mary-le-Bow. The parapet of the lantern is 5 inches thick, with diminutive buttresses 3 inches square behind the centre merlons, and it



stands on the cornice, the stones of which are carried through and form a walk round the spire. The water from this is carried off through small weep-holes at each angle of the spire, and drops down inside, this arrangement of the holes preventing the water falling on the beams.

As will be seen from the drawing, the large arches carrying the lantern are tied in at the springing by an arrangement of ties of flat bar-iron passing right round the angle pinnacles and crossing over the centre of the tower. They are fitted with union joints and are braced together vertically by diagonal straps, presenting, as seen from below, the appearance of lattice girders. These were added in 1868 by Sir G. Gilbert Scott, and were wrapped with spun yarn and tarred as a protection from the weather. This has proved an unfortunate experiment, as, the tar having perished, the yarn retained the moisture, thus causing greater oxidization than if they had been unprotected. This covering was all removed during the last repairs and the iron cleaned and painted.

There still remain within this modern ironwork the oak beams which fulfilled the same duty previously. These beams are arranged in pairs crossing diagonally from corner to corner of the tower, where they abut against the masonry of the pinnacles, and resting on each other in the centre where they cross, the lower one being supported by the apex of the roof. The spaces between the upper and lower beams of each pair are filled in with other pieces and the whole bolted together. The beams, which are considerably decayed in places, have been repaired at some time, new pieces being inserted attached to the old by scarfed joints. These newer pieces are at the ends, and are now decaying where they touch the stonework, owing to the latter becoming saturated by rain and retaining the damp. At the northeast and northwest corners small portions of the original iron straps remain though now corroded to extreme thinness. These had passed round the pinnacles and been secured to the oak beams by round-headed bolts. One of these is shown at A on the drawing. The straps show by their laminated structure that they had been forged. At some later time, probably when the beams were repaired, new iron straps were added. These are bolted to the oak by screw-bolts with square nuts of irregular sizes. Other straps were added above and below the beams, bolted right through and turned up against the soffits of the arches and down against the pinnacle, forged with a strong root in the bend and attached to the stonework by bolts in a much less satisfactory manner for giving a direct tie than the original straps. Although the oak beams are considerably decayed and the iron work corroded they would still be equal to their duties had the tightening up of the lattice ties by their unions not relieved them of all strain. I am inclined to believe that in the older of these beams and the traces of the iron straps remaining on the two north pinnacles we have the original ties inserted when the tower was built. When Mackenzie wrote in 1827 he mentions these beams as being encased in lead, which would account for their preservation. This was exactly what a mediæval architect would do. The encasing of wooden structures in lead is well exemplified by the lantern of Ely Cathedral. I do not know when the lead was removed, but there is no trace of it left now.

Although the structure may theoretically be capable of standing without ties, it would not do so in actual practice, exposed as it is to the fierce gales so frequent in this northeast corner of the country, to the occasional shocks of earthquake—which, happily, are of infrequent occurrence—and to the vibratory action of the bells. Experiments made with a heavy plummet suspended from the cross-beams of the lantern to just above the tie-beams below registered a swing of 15 inches in each direction during the ringing of the bells. This, of course, does not mean that the structure sways 30 inches, but certainly indicates a considerable movement, as indeed may be observed by the eye by getting the spire in line with a fixed vertical object while a peal is being rung.

The weight of a cornice pinnacle taken from the top of the cornice of the tower and including as many of the tower voussoirs of the arch as would stand unsupported (a point shown by the lower radial line on the section) is 73 tons. The weight of one arch above this point, together with one-fourth of the lantern and spire, being the weight supported by each pinnacle, is 30 tons.

(*To be Continued.*)

THE BUILDING AND THE DESIGNING OF THE "SKYSCRAPER."[1]

THE materials of construction of high office buildings may be classed under three heads—namely, masonry construction, skeleton steel construction and reinforced concrete construction. The first of these methods, masonry construction, depending on solid walls, is practicable to a certain limit only. As has been mentioned before, the limit is usually about ten to twelve stories in height, for the reason that beyond that height too much valuable space is necessarily sacrificed to walls. According to a table prepared by Mr. F. E. Kidder, the city ordinance requirements for a 12-story building in New York is 40 inches thickness for the first story exterior wall. The building law of Boston requires 36 inches for the same wall; St. Louis, 34 inches; Denver, 30 inches; while Chicago is satisfied with 28. Truly, a great variation in the factor-of-safety.

On the basis of the New York requirements, a building 300 feet high would require a wall 7 feet thick, which practically puts a limit to masonry-constructed walls for skyscrapers on a 25-foot lot. So we may dismiss this method of construction from the skyscraper problem.

The first advance from masonry construction was the use of cast-iron columns, which were protected with fireproof coverings. But since the possibilities of steel construction became known very little use has been made of cast iron for columns. One reason for its disuse is the difficulty of making satisfactory tests of its strength, owing to the possibility of the shifting of the core in casting. My own experience leads me to be cautious in the use of cast-iron columns. In one instance the usual tests were made for thickness of shell, no defects were apparent, but later the same column fell off a wagon and broke in two, showing a bad flaw, thus saving my reputation.

When steel columns were first used in high buildings they were merely to support the floor loads, as in the *World* Building in New York. This building is 199 feet to the roof line, with self-sustaining brick walls, faced with sandstone and terra-cotta, the thickness of the wall being 11 feet 4 inches at the bottom and 2 feet at the top. The steel columns were let into chases in the wall in the lower stories and set free above. The next step in high building construction was the skeleton steel frame, in which all floor and wall loads are transmitted directly to the columns and by them to the foundations. The girders of each floor are calculated to carry the floor load and exterior curtain-wall for that story, thus eliminating the necessity of exterior wall except for protection from the weather. The thickness of these walls varies in accordance with the ordinance of different cities, and in all cases the walls are thicker than is necessary.

The Chicago building-law requires that the curtain-wall of a building 250 feet high shall be 12 inches thick for the first 150 feet from the top, 16 inches for the next 50 feet and 20 inches for the lower 50 feet. Mr. W. H. Birkmire, the well-known authority on steel construction, recommends lighter curtain-walls as being safe and reducing expense.

Time is saved by adopting skeleton steel construction for this class of buildings on account of the rapidity with which they can be erected. The Central Bank Building in New York, 75 by 150 feet, fifteen stories high and two below the sidewalk, was entirely completed in seven months.

The most essential part of the construction of a skeleton steel frame is the actual support or column. Other parts of the structure may be weak without causing more than local damage, but when a column fails the entire structure is liable to fall, and hence the greatest care of architect and engineer must be used in calculating stresses and framing columns and their connections.

There are various shapes of built-up columns, each with some particular feature, all suitable for this class of construction and used at will by the architect, the design depending largely on the time limit under which manufacturers will agree to fill orders. Whatever structural shape is used, whether for columns, girders, floor beams, trusses or braces, actual tests have proved that the burning of the ordinary contents of a room will heat unprotected steel to a degree that will entail disastrous results when a stream of water is thrown on the heated metal. This fact renders it absolutely necessary to encase steel in non-combustible material.

When we speak of a fireproof building we use the term relatively, since the expense of an absolutely fireproof building is too great to admit of general use. Buildings constructed so as to secure a salvage of 60 to 80 per cent. are considered fireproof. It is not necessary to discuss the various fireproof materials, for the the Baltimore fire proved cement is the best fire-resisting material.

While concrete has been used in building for centuries, and steel framed structures have become common, a new method of construction has come into use by the combination of these two materials, steel and concrete, in what is known as armored or reinforced concrete. The earliest record of reinforced concrete mentioned by Mr. Kidder is the invention of P. A. J. Monier, a

[1] Extract from a paper by Mr. Edward S. Hammatt, architect, read before the Contemporary Club, of Davenport, Ia.

gardener of Paris, in 1867. In 1869 François Coignet, of Paris, secured a patent on a combination of iron and concrete. In 1875 W. S. Ward constructed a building near Portchester, N. Y., in which not only all the exterior and interior walls, cornices and towers were constructed of concrete, but all of the beams and roofs were exclusively made of concrete reinforced by light iron beams and rods.

European engineers have done more with reinforced concrete than American engineers, for the reason that our steel plants have produced structural steel of such excellence, the use of concrete has been neglected until within the last few years. While reinforced concrete has been used for some years for bridges and other engineering work, the first skyscraper to be built of this material was the Ingalls Building, of Cincinnati, O., begun in the fall of 1902 and designed by Elzner & Anderson, architects.

From experiments with concrete and steel made by M. Considère, Capt. John S. Sewell, U. S. Engineer Corps, and others, and the exhaustive tests at Watertown Arsenal, we learn many interesting facts. One of the latest investigators, Mr. J. W. Schaub, makes the statement that if a rusty bar of iron is inserted in concrete mortar for fifteen to twenty days it will be found free from rust, due to the iron giving up its oxygen to the cement. He adds: "The cement being anhydrous and alkaline in its reaction, will prevent the formation of rust, so that a coating of cement mortar should be, from a chemical and physical standpoint, an absolute protection against rust."

While engineers are making these and other tests[1] with many different assumptions and empirical formula, we are impressed with the lack of uniformity in the factor-of-safety.[2] We are impressed with this lack in all structural designing.[3] In ordinary construction, such as we have to deal with in a city of this size, it is the writer's custom to take the average given by available authorities. This should not be necessary and could be avoided if all tests of strength of materials were made and formulated under Government inspection. It has been shown that steel reinforcement prevents shrinkage of the concrete and greatly adds to its tensile and compressive strength. Further advantages of reinforced concrete are its cheapness of construction in comparison with structural steel and its fireproof quality. This last characteristic was thoroughly tested in the late Baltimore fire. After the fire, interest centered in a small four-story brick building, with a cast-iron front, the interior of which had been remodeled shortly before the fire, the exterior walls had been retained while the new columns, girders and floors had been constructed of concrete steel. The exterior walls were found demolished, but the interior walls were intact, except where injured by falling walls, proving beyond doubt the fireproof qualities of concrete construction. Another advantage of concrete is that ornaments and other details can be moulded of it.

There are many systems of reinforced concrete, the variation being due to the different forms of steel reinforcement. That in the Ingalls Building, mentioned above, is of cold-twisted square bars, used throughout. This system greatly increases the tensile strength of the bars after twisting and increases the mechanical grip of the bar on the concrete. The Ingalls Building is 50 by 100 feet on the plan, sixteen stories high, 210 feet above and 20 feet below the sidewalk to bottom of foundations. The entire structure is reinforced, consisting of steel bars imbedded in concrete with their ends interlaced, making a concrete monolith. The exterior walls are faced with marble for the first three stories, glazed gray brick for the next eleven and glazed white terra-cotta for the last story and cornice. The foundations are all of reinforced concrete.

In New York City, when it is necessary to go to great depths for foundations, the pneumatic process is successfully used. In Chicago a system of grillage, on piles, of I-beams and concrete, has been in use for several years. And now that reinforced concrete piles are available, and do not have to be cut off at the water-line to prevent decay, we have a fireproof, windproof and practically indestructible building as the result.

In view of the possibility of conflagrations liable at any moment to temporarily jeopardize the business interests of every city, it is necessary that the requirements for materials and construction of buildings in such districts should be most rigid. It should be made a criminal offense to erect a building that is not fireproof in congested business centers.

The business interests are not the only interests to be safeguarded. Thought should be given to the æsthetic side of a city's life and provision made for it. There should be in force in every city laws regulating the height of buildings. European cities, backed by centuries of art training, regulate the height of buildings on purely æsthetic grounds.[3]

When we consider the last division of our subject, the æsthetics of the skyscraper, we must remember that our æsthetic training is based on the proportions of Classic architecture—the low buildings of the Grecian archipelago. We are appalled at the seeming hopelessness of reconstructing our æsthetic ideas on such a gigantic vertical plane as a skyscraper demands. It may be said that architects have had a vertical problem to deal with before, in the Gothic cathedral. That is true, but the conditions are entirely dissimilar, there was a proportionate breadth at the architect's disposal.

Many of the skyscrapers are on lots so narrow in comparison with their height that little remains to deal with but a vertical streak, as in the acute angle of the "Flatiron" or Fuller building of New York. Attempts have been made to reduce the apparent height of these buildings by the use of repeated horizontal lines. The result of such treatment is seen in pronounced form in the St. Paul Building in New York. Here the designer has grouped two stories together and piled section on section in monotonous uniformity until the client's money-limit was nearly reached, when, in a sublime effort, three stories are grouped above a sub-cornice and his attempt is finished—a procedure, as one writer puts it, "Quite as sensible as if a man were to thrust his head through the crown of his hat and wear it below his head instead of above it."

Various other styles of high office buildings are seen. Few are satisfactory in appearance. Their designers strive for effect by dividing the façades horizontally and vertically. Pretentious detail runs riot. All our architecture needs restraint, needs a more refined sense of proportion—a more conscientious use of detail.

There are a few skyscrapers which are designed in a rational way, their architects realizing that the problem is one of vertical design and treat it accordingly, not even attempting to work out the design in any of its existing architectural styles. The original Monadnock Building in Chicago, designed by Mr. John W. Root, is one of the best examples of good design in skyscrapers. It is a building of the severest plainness. The necessary strength of base is secured by a gentler outward curve above the first story, an effect of batter being secured by champfering up the angles, widening as it rises several stories in height. The superimposed stories have plain, rectangular openings. The expanse of blank wall is broken up by shallow oriels, equally spaced, starting above

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[1]The U. S. Weather Bureau has made a series of experiments to determine the necessary reductions for wind velocity and pressure required to correct the anemometer record. As the writer has never seen any mention of such reductions, in works on strength of materials, these formulas with a table of indicated and reduced velocities and pressures are given, through the courtesy of Mr. Sherier.

PRESSURES AT STATIONS NEAR SEA LEVEL.

Indicated velocity.	Corrected velocity.	Indicated velocity.	Pressure (lbs. per sq. ft.).
0	...	0	....
10	9.6	10	.369
20	17.8	20	1.27
30	25.7	30	2.64
40	33.3	40	4.44
50	40.8	50	6.66
60	48.0	60	9.22
70	55.2	70	12.2
80	62.2	80	15.5
90	69.2	90	29.2

Formula for determining wind pressures:

$P = .004\ SV^2$.
P = Pressure, lbs. avoirdupois.
S = Surface sq. ft.
V = Corrected wind velocity, miles per hour.

Formula for reducing indicated velocity to corrected velocity:

$\text{Log } V = 0.509 + 0.9012 \log v$.
V = velocity of wind in miles per hr.
v = linear velocity (miles per hr.) of cup centers of anemometer.

[2]A factor of safety of 4 is legalized in the States of Michigan, Ohio, New York and Pennsylvania.

[3]Letters of inquiry were sent to the U. S. Consuls at a number of European cities, asking what restrictions are in force regulating the height of buildings and the reasons for such restrictions. I am indebted to the courtesy of the Consuls-General and Consuls of the following cities, and the city engineer of Birmingham, England, for replies tabulated below:

Birmingham, England.—No limit to height of buildings, except as to thickness of walls, and the law regarding ancient lights.

Edinburgh, Scotland.—Height of all buildings, from level of pavement to ceiling of highest room, must not exceed the width of street, and in no case more than sixty feet high without the consent of the Town Council.

Paris, France.—Height of building must not exceed width of street by more than 6 metres (19½ feet) for every additional metre in width of street ¼ of a metre (about 10 inches) may be added to height of building until the limit of 20 metres (nearly 66 feet) to the eaves is reached; but no building may exceed that.

Rome, Italy.—Height of buildings limited to twice the width of street.

Berlin, Germany.—Limited to 22 metres (about 72 feet) from curb to cornice. The reasons are (1) Height of building limited to width of street. (2) That is as high as the fire department can work effectively in extinguishing fires or rescuing people from upper stories. (3) It secures a uniform sky-line and preserves the architectural beauty and harmony of the street.

Vienna, Austria.—Height of buildings limited to 25 metres (82 feet). The reason is, so light and air be not too much shut off.

the outward curve of base, at top of second story and extending to the story below the frieze line.

The cornice is formed by repeating the gentle curve of the base. The proportions of this building are so carefully studied that in spite of its austerity it is one of the most pleasing and satisfactory of skyscrapers. The pleasing effect of the building could have been heightened by using a lighter colored material, the dark-colored brick and terra-cotta being almost too somber for such a massive structure.

Among other skyscrapers of successful design there are but two I shall mention as being exceptionally satisfactory. One is the Schiller Building, of Chicago, designed by Mr. Louis H. Sullivan, and the other is the preliminary sketch for the *Times* Building, New York, by Mr. Cyrus L. W. Eidlitz. This sketch is Gothic and of unusual charm. Unfortunately, the design was modified in construction.

While we have a few individual examples of fine design the problem of effective treatment of the skyscraper is one still open to solution.

A TROUBLESOME BRIDGE PAVEMENT.

WITH the exception of a small part of the sidewalk on the Cambridge side, says the *Boston Transcript*, the satisfactory paving of Harvard Bridge has at last been accomplished. Workmen are now engaged in putting the finishing touches on the eastern walk on the Boston side, and when the Cambridge sidewalk has been relaid the long chapter of failure and experimentation that this bridge has undergone will be closed. For the first time in its existence of fourteen years it will have a pavement that will stay in place, regardless of weather conditions and traffic stress. The history of the attempts to bring about this apparently simple state of affairs is one of considerable interest, and shows with unusual clearness the difference between theoretical design and actual accomplishment.

When this great traffic way between the Back Bay and Cambridge was first opened it was paved with concrete from rail to rail. The bridge presented a smooth surface that was both pleasing to the eye and ideal for travel. This condition of affairs was short-lived, for hummocks and cracks appeared that made walking or driving both unpleasant and dangerous. Paving experts were called in, and the conclusion was reached that the concrete was not heavy enough to withstand the strain imposed upon it by the stress of traffic. More concrete was added, and a temporary improvement resulted. The cracks soon reappeared, wider and deeper than before, while in other places the pavement rose in mounds like the waves on some solidified sea. It was then that the Harvard Bridge began its career as a trouble-maker—a career which has attracted wide attention in engineering circles.

On either side of the draw, in the centre, Harvard Bridge consists of ten arches, arranged alternately, 105 and 75 feet in span. These arches are formed of parallel rows of plate-girders, which rest upon masonry piers. The longer spans rest solidly upon the stonework of the piers, but the 75-foot ones are loosely swung from the ends of the longer ones, this plan having been adopted to give play for the expansion and contraction of the metal comprising the bridge floor. The total length of the bridge is 2,157 feet, including the swinging draw in the centre. Aside from the twenty arches mentioned, there is a 90-foot arch on each side of the draw, and an extra arch at the Cambridge end of the bridge. As less than half of these arches are arranged to move with the expansion and contraction of the bridge floor, it can readily be seen that the movements of the stationary arches were sufficient to cause the cracking and heaving of the concrete pavement which stretched in an unyielding sheet from either shore to the central opening for the swinging draw.

Engineers, called in consultation, soon demonstrated this fact, and then all efforts were devoted to discovering some method whereby this expansion and contraction could be compensated. It was first decided to lighten the concrete pavement, and in order to do this the former roadway was torn up, and a thin layer of concrete was put down on a plank foundation. This soon proved unsuccessful and was taken up, and a plain plank roadway was substituted in the centre of the bridge, the concrete pavement being left on the sidewalks. A marked improvement was at once noticed, as the wood was sufficiently elastic to accommodate the strains put upon it by the movement of the metal floor of the bridge. But a new difficulty soon appeared: the constant wind dried the wood and gave it a tendency to flake. The exposure to rains, the alternate wetting and drying, and the continual crushing of wagon-wheels soon turned the planking into a spongy, unsafe mass that needed frequent renewal.

Various woods were tried, various methods of laying the planking, but all to no effect. Scarcely a month passed that some part of the bridge was not blocked off from use while the roadway was being relaid. This condition was kept up for years with little change. Then the use of wooden blocks as a pavement was suggested, and this scheme was tried in an experimental section. The results were most satisfactory, and it was decided to pave the entire roadway in this manner. This has now been done throughout, with the exception of the draw, and the plan is giving perfect satisfaction. The wooden blocks are set on end on a foundation of planks laid at an oblique angle to the axis of the bridge, thus presenting a yielding mass of wood to the strains of compression brought about by the movement of the anchored arches. As the grain of the wood in the blocks runs perpendicularly, a hard and practicably non-crushable surface is presented to the wear of passing wheels, thus saving the roadway from being cut into ruts.

This solution of the problem was found to be financially impracticable for the sidewalks, however, and there the concrete and asphalt pavements were continued in use. They eventually became so uneven as to be actually dangerous to walk upon. Experiments were then begun to find a suitable pavement for this portion of the bridge, and the most successful method devised is now nearly completely installed. The former concrete walks have been removed, and in their place a board walk has been laid, a space being left between the narrow strips of hardwood that make up the pavement to allow for the movement of the bridge-floor.

One other bridge, because of its construction, has shared with Harvard Bridge this misfortune in pavements. This is the Washington Bridge, a steel arch that spans the Harlem River, in the northern part of New York City. The expansion and contraction of the metal work in this bridge has been so great that it has entirely wrecked the roadway that traverses it, making it necessary to close it entirely upon certain occasions. This bridge, also, has an ornamental stone railing on either side, and the heaving and subsiding of the bridge-floor underneath has at times dislodged portions of this rail and sent them hurtling to the water below.

ILLUSTRATIONS.

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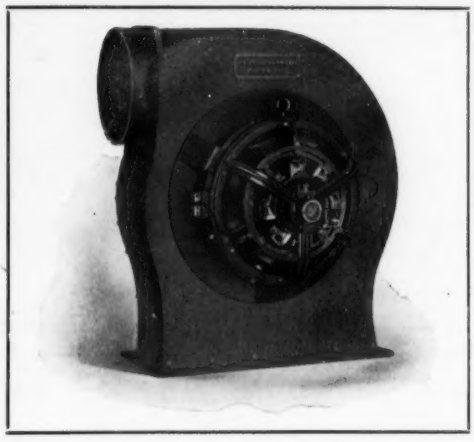
NOTES AND CLIPPINGS.

THE DETROIT MUSEUM OF ART.—The Detroit Museum of Art has almost completed the large addition to its building which was authorized by an issue of bonds to the amount of $50,000 by the city of Detroit. In the new part is a fine lecture hall, accommodating nearly one thousand persons. Last month two of the new galleries were opened with an exhibition of pictures by Michigan artists. There is another gallery to be completed. On the lower floor the additional space almost doubles the capacity of the museum.



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NOTES AND CLIPPINGS.

Continued from page ix.

are also known to occur in Rapides Parish in Southern Louisiana. The force of the air-current in one of the Louisiana wells is sufficient to keep a man's hat suspended above it. The cause of such phenomena is mainly due to changes in atmospheric pressure or to changes in temperature. During the progress of a low-barometer storm over these regions, the air is expelled from the blowing wells. With a rising barometer, the blowing becomes rapidly less until the current is finally reversed. Differences in the temperature of the surface air and the air in the soil also produce similar effects. When the interstices between the grains of sand, gravel, etc., in which the well is driven are filled with water, the phenomena of blowing is much less noticeable. The Survey will welcome any information from well owners and drillers relating to these wells.—*The Building News.*

BUENOS AYRES A GREAT CITY.—Americans who are concerned about the large immigration of Italians and other natives of Southern and Southeastern Europe might well give their attention to an object-lesson in the largest city of the Southern Hemisphere. It is impossible to do justice to the growth of Buenos Ayres without deep appreciation of the possibilities of our newest great stream of immigration.

That city of Spanish origin and Spanish and Italian building-up to its present greatness has passed the million mark this year. Thirty years ago it was much smaller than Rio Janeiro or Melbourne. No one with the pride of race that usually marks the Anglo-Saxon could have supposed at that time that the largest city of Australia, with its long lead over Buenos Ayres, would ever be overtaken and left far behind. Now Buenos Ayres is twice as big as Melbourne or Sydney and growing much faster.

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The Argentine capital is one of the most progressive and imposing cities of the world. The country which has concentrated about 20 per cent. of its people in that city has more than three times as great a foreign trade as the United States in proportion to population. The growth of the exports and imports of this country is slow and modest by comparison with the gains of Argentine commerce, taking account of the relative number of inhabitants. Buenos Ayres has a greater immigration than New York in proportion to the population of the Argentine Republic and the United States.

The Latin-Americans of Spanish origin, greatly strengthened in the Argentine by Italian immigration, have undeniably made a wonderful success of the settlement and development of the foremost country of South America. What reason is there to doubt that the Italians who have flocked to the United States will prove equally successful and useful in this country?—*Cleveland Leader.*

TRADES UNIONS IN FRANCE.—The growth of trade unionism in France, *Engineering* remarks, has been very rapid. The title under which the unions are known in France is "Syndicats Professionnels." They were first authorized by law in 1884, a little over twenty years ago. Under that law associations are permitted of more than twenty persons exercising the same trade or calling to be formed for the purpose of promoting or defending their economic, industrial, commercial or agricultural interests. Such associations are empowered to acquire property and institute special funds for mutual help, superannuation and other benefits; the only condition of their regular establishment and legal status is publicity. The "syndicats" have a wider meaning than we attach to the term "trade union" in England, for they include unions of employers as well as of work people, and also mixed associations of both. The increase of unions in fifteen years is nearly fourfold, while the membership has increased from 481,438 to 1,719,196, or about three and a half times. On Jan. 1 of this year the employers' union had 252,036 members, the work people's unions 781,344, mixed unions 25,863 and agricultural unions 659,953. These institutions cover all sorts of objects of an industrial and commercial

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character, including friendly and other provident societies. Under the law of 1892 doctors, dentists and midwives are also empowered to form associations for mutual protection.—*Dundee Advertiser.*

The Kiln-drying of Wood.—Drying is an essential part of the preparation of wood for manufacture. For a long time the only drying process used or known was air drying, or the exposure of wood to the gradual drying influence of the open air. Kiln-drying, which is an artificial method, originated in the effort to improve or shorten the process. Kiln-drying is so important a process that a need is keenly felt for fuller information regarding it, based upon scientific study of the behavior of various kinds of woods at different temperatures and under different mechanical drying devices. The Forest Service has begun a study of the dry-kilns throughout the country, first, to acquaint itself with the methods now in vogue, and, second, to map out such improvements of the kiln-drying process as may render it in the highest degree satisfactory and profitable.

Mr. Frederick Dunlap, of the Office of Forest Products in the Forest Service, who was assigned to this study, has during the past weeks inspected kiln-drying methods in the States of Indiana and Wisconsin, and in the city of Chicago. In Indiana, a hardwood region, the prevailing method of kiln-drying is based upon the use of steam pipes, which supply the dry heat required in the kiln. The pipes run on the floor of the kiln, and the lumber is placed over them. The radiated heat from the pipes dries the lumber. In Wisconsin soft woods are more widely manufactured, and blower kilns are more generally used. In these air is pumped by means of a circular fan through a steam coil, and so heated, and then passes on to the chamber in which the lumber is piled.—*New York Evening Post.*

Genoa's New Harbor Works.—King Victor Emmanuel laid the corner-stone of the new harbor works Oct. 29. It is estimated that the new works will cost $15,000,000.

Statistics of Forest Products.—The annual value of the forest products of the United States, as enumerated in the twelfth census, is nearly $575,000,000. If to this were added the value of the firewood, farm material, and other forest products for which no returns are available, a very much larger figure would be shown. Thus, as a direct source of wealth the forests of the country rank nearly with the mineral products as second to the farms. In addition to monetary value, the forests of the country have an immense, though not exactly calculable, value as a source of future supply and as a protective covering for watersheds. Forest products are indispensable to mankind, and their steadily increasing price surely indicates that the demand is encroaching upon the supply. It is urgently important to the nation that the yearly consumption of forest products and the amount of available timber yet standing should be known.

In accordance with its policy of encouraging the preservation and proper use of the forest, the Forest Service is aiming to secure statistics for publication in a report

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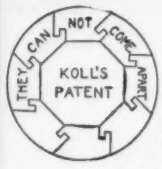

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in the hope that co-operation with the industries concerned will make possible an annual report, entitled "Forest Products of the United States." This proposed report would give, by States, regions and species, the cut and shipments of lumber, shingles, lath, cooperage stock, ties, posts and poles during the year; the stock on hand at the close of the year; and also the amount of wood used in the various industries for which wood furnishes the raw material, and the value of the products. It would also give information concerning the amount of stumpage in the hands of lumbermen in various regions, how long it will last at the present rate of cutting, the extent of damage by forest fires, and other important matters relating to the forests of the country.

In order that the expense of collecting the statistics for this report shall not be excessive, nearly all the data will be obtained through correspondence. The names of proprietors of logging-camps, sawmills, pulp-mills, woodworking plants, and other manufacturing establishments for which wood is the raw material, will be secured from the bureau of the census. At the close of the present calendar year, a question card will be sent to each proprietor to be filled out with answers relating to his particular line of business. The replies will be held strictly confidential and only State totals will be published.—*New York Evening Post.*

FRENCH POLISH.—The best possible finish that can be put on hard or soft woods is the lacresin, or what is commonly called "French polish." It presents a deep glazed surface, as smooth as plate-glass, and will wear for years. The writer has pieces of furniture, notably a hardwood stand, in his house, to the surface of which a French polish was applied fourteen years ago. It is as bright to-day as it was the hour it was finished; indeed, the wood has enriched the finish with its deeper tint of age.

So far as ingredients are concerned French polish is a very simple thing; but to secure the best results, even when done by experienced finishers and varnishers, requires some little experience. It is work that demands a good price, and the few men I have known who followed it exclusively commanded better wages than the ordinary painter.

To get the French polish, first cut the shellac in pure alcohol, reducing it to the consistency of thin cream. Apply with a wad or roll of woolen cloth, with an outer wrapping of linen, the entire bunch being of a size that can be conveniently held in the hand. Open the wad and pour in the shellac and alcohol till it oozes through the linen slowly when squeezed in the hand. Experience will teach you just how much to pour in, and just how and when to squeeze the wool.

But to secure the French polish it is first necessary that the wood be well prepared. It must be given an absolutely smooth surface, by ample planing and sanding. Hardwoods are the best. Pines can be finished beautifully in this way, but their softer surface does not insure the durability that oak, walnut, ash, maple and other hardwoods insure.

If a natural finish is desired, first rub the wood, after it has been sanded and prepared, with tallow or raw linseed. Tallow is preferable, as it fills the pores and cracks and makes a smooth surface for the polish. Rub off the tallow or linseed with a rag or soft shavings—anything that will not scratch. And again, if a light finish is desired, use white shellac, but if a dark finish is wanted, such as walnut or dark cherry, use brown shellac.

With your surface well prepared and the polish mixed and poured into the woolen wad, you are ready to begin. The process is one of rubbing, rubbing, rubbing. Make as long sweeps as possible, and squeeze out the liquid just as the rubbing demands. You will soon learn the proper flow, as either too much or too little will make the rubbing entirely different from what it is when just the right amount of shellac is fed out.

Temperature is another thing that must be looked after. If done in the winter, the polish must be applied in a room heated to at least 60 degrees. If it is warmer than that all the better. It is easily understood that if the weather is too cool, the shellac will not run fluently, and a poor surface will result.

From time to time during the rubbing process sprinkle a solution of raw linseed oil and kerosene, in the proportion of seven parts of the former to one of the latter, over the surface, flipping it on from the ends of the fingers, and rubbing it in with the shellac cloth.

As to the length of time required, it is difficult to say. I have known an expert at the business to work two or three days on the surface of a single bar or banking counter. If you have a small surface you can, of course, get over all parts of it more frequently, and thus hasten the final glazed finish. The longer and more persistent the rubbing the deeper and more "built up" will be the finish, giving it much the appearance of being covered with thin plate-glass, and with every mark and figure in the grain of the wood standing out in beautiful outline. As already hinted, this polish is especially good for bar and banking counters, stands, dining-tables and desks. Its hard, smooth surface withstands more batter and wear than any other finish that has come to the attention of the writer. You can spill all the ink you want on a French-polished counter or desk; a wet rag and a little rubbing will leave it as bright and clean as before.

The finishing touches are put on with pure alcohol applied through the same wool and linen used with the shellac. Just keep on rubbing in the alcohol till the rag is clean, and you will have a highly polished, "built up" surface that will last through two or three generations, if not battered by hard hammering and use. The polish can only be applied to flat or convex surfaces, or very wide concave surfaces, as the rag must reach all parts of the exposed wood, which cannot be done in small grooves or corners. —DENNIS H. STOVALL, in *Western Painter.*

A WORD OF WARNING ABOUT REINFORCED CONCRETE.—A "Fellow" of the Surveyors' Institution writes as follows to the *Builders' Journal:*

"In view of the strong tendency displayed in many quarters to employ reinforced concrete for almost every purpose, a word of warning to some at least of the younger professional men will not perhaps be out of place.

"With his strong conservative bent, the Englishman went on for years ignoring what was being done on the Continent and elsewhere with a combination of steel and concrete, till one day it seemed suddenly to

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dawn upon him that such a form of construction was perhaps feasible. Then he went to the other extreme. Visions of concrete, at perhaps 18s. a yard, very thin, with a few pieces of stout wire stuck through it, arose before him as a substitute for more legitimate construction, and these visions are still enjoyed by many—especially by laymen with would-be-scientific minds.

"Now, as a matter of fact, the economy of using reinforced concrete as a building material is often a moot point. For instance, the 9 inches by 9 inches reinforced beam illustrated in your last issue would cost more than £1, while a rolled-steel joist to do the same work could be obtained for less than 15s.; moreover, the co-efficient of risk that reinforced concrete entails, owing to bad workmanship, is very high, whereas with a rolled-steel joist the risk is practically nil. The concrete must form a homogeneous whole; it must be in perfect contact with the steel; and the cement must not swell in setting, or it will set up a tension in the steel before it is even loaded with the weight it has to carry. To obtain concrete of this homogeneous quality it is necessary to carefully grade the shingle in a way that an old-fashioned contractor would call "playing shops"; and then it has to be carefully measured in the proportions that are found to produce the best results with the particular grades of shingle and sand being used. Concrete made in the old-fashioned way by mixing two bags of cement to about a cartload of "the best I can get" kind of shingle hardly belongs to the same family as that necessary for reinforced work. The equally important necessity of perfect contact between concrete and steel is only obtained by "elbow grease," the concrete being carefully punned with small punners until the required adhesion can be fairly relied on; and it is evident that this will only be done well when there is a supervision almost approaching to that of the sentry over the convict.

"If, then, after carefully considering the matter, it is found that reinforced concrete is cheaper or more efficient, by all means let it be used; but let it be really for one or other of these reasons that we adopt it, and not because it is the latest gilguy."

A High Chimney Stack.—One of the highest smokestacks in Pennsylvania will be that at the new power-house of the Lehigh Valley Transit Company, at Allentown, Pa. Operations were begun recently. The stack will be 240 feet high, circular in shape and 12 feet in diameter.

Recovering a Lost Raft of Oak Logs.—A correspondent of *The Chicago Record-Herald* tells a romance of lumbering in Canada. About seventy-five years ago Joseph Demister had a huge raft of white oak logs caught in the ice and frozen up on Lake Scugog. In the spring the raft was missing, and several years later he found it imbedded in the mud at the bottom of the lake. The story of the sunken raft was repeated in the family from generation to generation, until last summer a great-grandson of the original lumberman determined to recover the timber. He has been at work since last June, and about September 1 located it under thirty feet of water, imbedded in the mud bottom of Lake Scugog. He engaged divers, and is now at work cutting out the logs and releasing them from their imprisonment of three-quarters of a century. Mr. Trimble congratulates himself upon having found a fortune, as there are at least several hundred logs in the raft, and some people think there are several thousand of them. Each log will probably average 160 cubic feet of white oak, which is worth at least $1 a foot. Experienced lumbermen say that the timber has not been injured, but is more likely to have been improved by its long immersion.

Animal Statuary for the Tuileries Garden.—Two plaster models of stags, executed by Auguste Cain for the Château de Chantilly, have been set up on pedestals recently erected in the Garden of the Tuileries in Paris. These models were given to the Museum of Decorative Arts by the Duc d'Aumale.—*Exchange.*

BUILDING NEWS.

(The editors greatly desire to receive information from the smaller and outlying towns as well as from the larger cities.)

Albany, N. Y.—It is reported that the John G. Myers Co. will erect a steel skeleton building on James St. from plans by Trowbridge & Livingston, New York.

Ames, Ia.—It is reported that Iowa State College will erect next year an agricultural hall, to cost $300,000, from plans by architects Proudfoot & Bird, of Des Moines.

Asheville, N. C.—Plans for a 5-story stone office building, 100 x 120 ft., are being made by architect R. S. Smith.

Atlanta, Ga.—It is reported that Dr. Horace Grant (Box 194, Atlanta) intends

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The complete edition of *The Georgian Period* is published in three forms, the style and price of each of which are: Twelve parts in separate portfolios; if payment is made in instalments, $60.00; cash with order, $57.00. Bound in three large volumes; dull surface brown canvas, with leather label, $63.00; half morocco, $66.00. 851 plates; 525 text illustrations.

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to have plans made for a 12-story fireproof building, to cost $750,000, and to contain offices, hotel and theatre.

ATLANTA, GA.—Morgan & Dillon, architects, 707 Prudential building, have plans in progress for building for College of Physicians and Surgeons. Cost, $80,000.

BENTLEY, KY.—The patrons of Bentley High School are preparing plans for the erection of a $40,000 school building, to be erected on the site of the one recently burned. Address B. F. Adams, architect, Bentley, Ky.

BALTIMORE, MD.—Messrs. Simonson & Pietsch and Wyatt & Nolting have been invited by the Municipal Hospital Commission to prepare competitive plans for a hospital for contagious diseases.

BALTIMORE, MD.—It is reported that a new municipal hospital is to be erected and that competitive plans will soon be called for.

It is reported that plans are filed for the Girard Trust Building, to be erected on Broad and Chestnut Sts., at a cost of $2,000,000. Plans by Furness & Co., Baltimore, and McKim, Mead & White, New York, associated architects.

BETHANY, W. VA.—C. C. & A. L. Thayer, New Castle, Pa., have the contract for building the new Carnegie Library at Bethany College, W. Va. Cost, $40,000. Rev. T. E. Cramblett is president of college.

BUTTE, MONT.—A clubhouse is projected by the Silver Bow Club, to be built on a recently acquired site at Granite and Alaska Sts.

CHICAGO, ILL.—Press clippings state that Marshall & Fox, architects, 164 Dearborn St., are about to let contracts for a stable and show ring, to be erected at 59th and Paulina Sts., for M. H. Tichenor & Co. Cost, $60,000.

L. Mart Mitchell, 145 La Salle St., has, it is said, prepared plans for a $120,000 apartment house at Indiana Ave. and 37th St.

A 5-story addition, to cost $50,000, will be made to the Oakwood Hotel, Drexel St. and Oakland Boulevard, from plans of Andrew Sandegren, architect.

COLUMBUS, O.—Bids will be received until Nov. 20 by the building committee of the Board of Education for three new school buildings.

DENVER, COL.—The Matthewson Automobile Co. is said to be about to build a $20,000 garage on Broadway from plans of W. E. Fisher, architect.

DETROIT, MICH.—E. A. Schilling, architect, will receive bids for the building of a $100,000 casino at Belle Isle Park.

DULUTH, MINN.—The Y. M. C. A. is raising funds for a $125,000 building. Address the General Secretary, Y. M. C. A.

ENID, OKLA.—Bids are desired for the building of a $100,000 county court house. Address the County Clerk.

EVANSTON, ILL.—It is reported that plans will soon be prepared for a $50,000 Carnegie Library.

FORT D. A. RUSSELL, WYO.—A cavalry drill hall, of brick with steel truss roof, is to be erected. Bids will be received until Dec. 2 by Capt. W. S. Scott, Cheyenne, Wyo.

HOMER, GA.—Bids will be received until Nov. 15 for erecting a new jail. J. W. Golucke, Temple Court, Atlanta, is the architect.

INDIANAPOLIS, IND.—It is reported that plans have been accepted for the new Board of Trade building. Cost, about $300,000. H. C. Brubacker, Jr., and W. K. Eldridge are associated architects.

JACKSONVILLE, FLA.—It is reported that the Hon. T. Stockton will erect a $100,000 office building of reinforced concrete, on Forsyth St.

All bids for erecting the new jail here have been rejected. It is not yet decided whether to call for new bids or to build by employing workmen by the day.

LOS ANGELES, CAL.—It is reported that L. W. Hellman will erect a $100,000 business building; Morgan & Walls, architects.

LOUISVILLE, KY.—Architects McDonald & Dodd have prepared plans for a 12-story fireproof bank and office building for the Lincoln Savings Bank, to cost $125,000.

MAUCH CHUNK, PA.—The American Hotel at Mauch Chunk was nearly destroyed by fire. It will be rebuilt. Cost, $45,000.

MAYKING, KY.—The citizens and patrons of Mayking Public School are to build a $40,000 school building, contract to be let at once. Walter R. Webb, Sergent, Ky., can give information.

MILWAUKEE, WIS.—It is reported that a State Normal school will be erected at State and 25th Sts., to cost $140,000, from plans by architects Van Ryn & de Gelleke.

MOLINE, ILL.—Mr. Olof Z. Cervin, archi-

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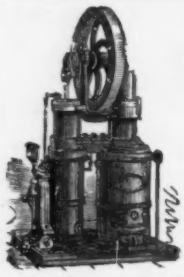

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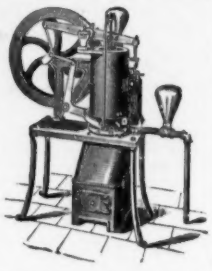

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PART I

This work is intended to supplement "The Georgian Period" and to treat of the furnishings which were used in the buildings described and illustrated in the latter.

The part now published treats mainly of Chippendale furniture. It contains an illustrated Glossary of Terms by W. S. Bigelow and an Introductory Chapter by Horace C. Dunham.

It has 28 plates, each 10x14 inches, showing photographic views and "MEASURED DRAWINGS" of the best existing examples. These last, by Mr. Dunham, constitute the main feature of the work.

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tect, is making plans for a new city fire station, 40 x 90 ft.; a 4-story warehouse, 35 x 96 ft. for the Mutual Wheel Co., and a colonial residence for Mr. R. B. Lourie.

Newark, N. J.—It is reported that Arthur Connelly, architect, 142 Market St., has plans completed for warehouse to be erected at Frelinghuysen Ave. and Lehigh Valley tracks for H. Koch & Co. Wood covered with corrugated iron, 3 stories, 280 x 317 x 453 ft. Owner will take figures immediately.

New York, N. Y.—The Board of Estimate has appropriated $800,000 toward the construction of the tuberculosis hospital at Staten Island.

Ernest Flagg, architect, 35 Wall St., has plans in progress for new office building to be erected at 311-15 W. 43d St. for Charles Scribner's Sons, 153 Fifth Ave. Brick, stone and terra cotta; fireproof; 11 stories; 100 x 125 ft.

Cady & See, architects, 6 W. 22d St., are, it is reported, taking figures on a church and parish house to be erected at 114th St. and First Ave., for the New York City Church Extension and Missionary Society of the M. E. Church, 150 Fifth Ave. Brick and stone, fireproof, 5 stories, 50 x 100 ft.

Parnassus, Pa.—M. P. Murphy, care of Standard Railway Co., St. Louis, Pa., has bought a 11-acre site at Parnassus for a large factory. No details announced.

Peru, Ind.—The County Commissioners have accepted plans of Crapsy & Lawson, architects, 17th and Race Sts., Cincinnati, O., for new court house here. Bids will be asked for in a few weeks.

Pittsburgh, Pa.—W. G. Park, care of Real Estate Trust Company, has bought a three-acre site at 36th St. and proposes to build a large manufacturing site. No details of the project are announced.

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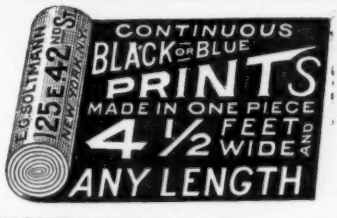

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Architect T. Ed. Cornelius, Ferguson building, is taking bids on a 12-story fireproof addition to the Hotel Lincoln in Penn. Ave. Cost, $100,000. Address A. L. Richmond, Jr., owner, Keystone building.

Semi-official announcement is made that the Shubert Brothers, of New York, will build a $1,000,000 theatre in Pittsburgh within the next 18 months. Negotiations for a site are now pending. Address them at New York or David Belasco, New York City.

Architect John T. Comes, Washington National Bank building, is taking bids on an amusement hall for the Melwood Grove Co. The building will have 22,000 square feet of floor space and will contain bowling alleys, parlors, dancing pavilion, auditorium, etc. Cost, $40,000.

E. F. Rusch has secured a site 94 x 127 ft. at Forbes and Boquet Sts., on which he proposes to erect a 6-story brick store and flat building. Plans will be drawn at once. Cost, $100,000. Address care of Land Trust Co., Fourth Ave.

Henry Phipps, Bessemer building, will build a new natatorium for the Pittsburgh Natatorium Co., 526 Duquesne Way. The building will be 50 x 120 ft. and will be started as soon as details can be arranged by the committee of the Natatorium Co. Address H. B. Naylor, Bessemer building, or John Llewellyn, care of Pittsburgh Natatorium Co.

The Emory Methodist Episcopal Church, North Highland Ave. and Broad St., has bought a site at North Highland Ave. and Rippey St. and will build a church, to cost $150,000. No architect chosen. Address Samuel Hamilton, Hamilton Hall, Wood St., Pittsburgh.

The Bank of Brushton has bought a site, 40 x 100 ft., and will have plans drawn for a 3-story bank and office building. Cost, $50,000. Address president of bank.

Attorney Elmer W. Moore, 502 Frick building, proposes to erect a 5-story business block at 1205 Fifth Ave. Cost, $40,000. No architect announced.

The National Metallurgic Co., New York City, has bought a seven-acre site at Aspinwall, just above Pittsburg on the Allegheny River, and proposes to erect a large plant. Address the president of the company.

The directors of the Birmingham Turnverein Association have decided to rebuild their hall on the South Side, which was lately burned. Address president of association.

Architect Charles Bickel, 524 Penn Ave., will be ready for estimates about Nov. 15 on the 8-story warehouse for Isaac Kaufmann at Wood St. and Second Ave. Cost, $150,000.

The Magee Memorial Committee has approved plans for the memorial to be erected for Christopher L. Magee in Schenley Park. The design was that of Mr. St. Gaudens and the memorial will be a massive stone or marble base fountain, with a medallion or bust of the former Senator and an allegorical figure representing charity.

ROCHESTER, N. Y.—It is stated that plans submitted by Architects Brown & Davis, Cincinnati, O., have been accepted by the trustees of the Parsells Ave. Baptist Church, and that a new stone edifice, to cost $100,000, will be erected.

ST. PAUL, MINN.—It is reported that plans will soon be asked for a new hospital to be constructed by the trustees of the Luther Hospital.

The Orpheum Circuit Co. will, it is said, build a theatre at St. Peter and Fifth Sts., from plans by architects Kees & Colburn, Minneapolis.

SEBRING, O.—The Keystone Steel Co. has secured a site and will build a big plant at Sebring. Cost, $200,000.

SERGENT, KY.—The church of the Old Regular Baptists will erect a $50,000 church edifice, in conformity with present plans, soon after the first of the new year, 1906. W. B. Webb, 305 E. Main St., Sergent, Ky., can give complete information.

SPARTANBURG, S. C.—Plans for an opera house seating 1,800 persons are being prepared by architect D. G. Ziegler.

SYRACUSE, N. Y.—The Knickerbocker Construction Co., 15 Cortlandt St., New York City, will build for the Lynch estate, Charles C. Cook and Walter McMullin, trustees, an apartment house, to accommodate 100 families. George Keister, 11 W. 29th St., New York City, will prepare the plans. Cost, $300,000.

SWISSVALE, PA.—Architect F. G. Scheibler, Jr., Milligan & Miller building, Wilkinsburg, Pa., has plans completed and will take bids as soon as the bond issue is approved on an 8-room brick school house in Braddock Ave., Swissvale. Cost, $50,000.

TACOMA, WASH.—It is stated that a 7-story apartment hotel, to cost $125,000, will be built on St. Helen's Ave. from plans by architect C. A. Darmer.

TIFFIN, O.—Dr. Charles E. Miller, president Heidelberg University, has just announced that Andrew Carnegie has given to that institution $25,000 for a new library building on the condition that the university raise a similar amount. Dr. Miller further announced that a portion of the money has already been raised and that the new library building will be erected next summer. Neither sketches nor building plans have been considered and an architect has not yet been selected. The university is further considering the question of erecting a power plant with capacity sufficient for heating all the college buildings, which with the present ones and contemplated ones number seven.

WHITESBURG, KY.—The Masonic fraternity of Whitesburg is to build a $60,000 lodge and office building. Contract is to be let at once. J. Hobson Gibson, S. Main St., Whitesburg, Ky., is the architect.

WINSTON-SALEM, N. C.—E. C. Bowman & Co., of Birmingham, Ala., have been awarded contract to build $100,000 hotel here.

WORCESTER, MASS.—It is said that the Worcester Railway Co. has plans for a $50,000 open air theatre, at Lake Quinsigamond.

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Spaulding Print Paper Co., Boston.

BRASS GOODS (Plumbers).
Standard Sanitary Mfg. Co., Pittsburgh, Pa.

BRONZEWORK (Ornamental).
Jackson, Wm. H., Co., New York.
Richey, Browne & Donald, Maspeth, L. I., New York City.
United States Foundry and Sales Company, South Norwalk, Conn.
John Williams, New York.
Winslow Bros. Co., The, Chicago, Ill.

CAPITALS AND COLUMNS.
Hartmann Bros. Mfg. Co., Mount Vernon, N. Y.

CEMENT.
Alsen's Cement Works, New York.
Atlas Cement Co., New York.
Illinois Steel Co., Chicago.

CEMENT (Non-Staining).
Morse, Frank E., Co., New York.

CLOSETS.
Standard Sanitary Mfg. Co., Pittsburgh, Pa.

COLUMNS (Lock Joint).
Hartmann Bros. Mfg. Co., Mount Vernon, N. Y.

CONCRETE CONSTRUCTION.
R. S. Blome Co., Chicago.

CONSERVATORIES.
Lord & Burnham Co., Irvington-on-Hudson, N. Y.

CONTRACTORS AND BUILDERS.
Morrill & Whiton Construction Co., Boston.

CORDAGE.
Samson Cordage Works, Boston.

DOORS (Steel Rolling).
Kinnear Mfg. Co., The, Columbus, O.

DRAUGHTSMEN'S SUPPLIES.
Favor, Ruhl & Co., New York.
Soltmann, E. G., New York.

DRINKING FOUNTAINS.
Standard Sanitary Mfg. Co., Pittsburgh, Pa.

ELECTRIC SIGNALS.
Elevator Supply & Repair Co., New York

ELEVATORS, ETC.
Otis Elevator Co., New York.

ENAMELLED IRON (Plumbers' Ware).
Standard Sanitary Mfg. Co., Pittsburgh, Pa.

ENGINES (Hot Air).
Rider-Ericsson Engine Co., New York.

FAN SYSTEM.
Sturtevant Co., B. F., Boston.

FILTERS.
Loomis-Manning Filter Co., Phila., Pa.
Cummings Filter Co., Pittsburgh, Pa.

FIRE-ESCAPES.
Standard Fire-escape & Mfg. Co., Boston

FIREPROOFING.
Associated Expanded Metal Co., New York
Blome, R. S., Co., Chicago.
Imperial Expanded Metal Co., Chicago.
National Fireproofing Co., Pittsburgh, Pa.
Trussed Concrete Steel Co., Detroit.
"Unit" Concrete Steel Frame Co., Philadelphia, Pa.

FIREPROOF LATHING.
Hayes, Geo., New York.

FIREPROOF SHUTTERS.
Kinnear Mfg. Co., The, Columbus, O.

FLOOR POLISH.
Butcher Polish Co., Boston.

FUEL ECONOMIZERS.
Sturtevant & Co., B. F., Boston, Mass.

GLASS (Figured and Ornamental).
Mississippi Wire Glass Co., New York

GLASS GLOBES.
Holophane Glass Co., New York.

GRATES, MANTELS, ETC.
Wm. H. Jackson Co., New York.

GREENHOUSES.
Lord & Burnham Co., Irvington, N. Y.

HARDWARE.
Sargent & Co., New York.
Yale & Towne Mfg. Co., Stamford, Ct.

HEATING APPARATUS (Hot Water).
Gurney Heater Mfg. Co., Boston.
Burnham-Hitchings-Pierson Co., Irvington, N. Y.
H. B. Smith Co., New York.

HEATING-APPARATUS (Steam).
Burnham-Hitchings-Pierson Co., Irvington, N. Y.
Smith Co., H. B., New York.

INSULATED WIRE.
The Okonite Co. (Ltd.), N. Y.

INTERLOCKING RUBBER TILING.
New York Belting & Packing Co., Ltd., New York.

IRONWORK (Ornamental).
Jackson, Wm. H., Co., New York.
W. H. Mullins Co., Salem, O.
Richey, Browne & Donald, Maspeth, L. I., New York City.
United States Foundry and Sales Company, South Norwalk, Conn.
Winslow Bros. Co., The, Chicago, Ill.

IRON WORKS.
Mott Iron Works, J. L., New York.

LAUNDRY MACHINERY.
Troy Laundry Machinery Co., Troy, N. Y.

LAUNDRY TUBS (Porcelain Enamelled).
Standard Sanitary Mfg. Co., Pittsburgh, Pa.

LAVATORIES (Porcelain Enamelled).
Standard Sanitary Mfg. Co., Pittsburgh, Pa.

LEAD PIPE.
Standard Sanitary Mfg. Co., Pittsburgh, Pa.

MAIL CHUTES.
Cutler Mfg. Co., Rochester, N. Y.

MARBLE.
Standard Sanitary Mfg. Co., Pittsburgh, Pa.

MARBLE-WORKERS.
The Robert C. Fisher Co., New York.

METAL CEILING.
The Berger Mfg. Co., Canton, Ohio.
W. H. Mullins Co., Salem, O.
See also Fireproofing.

METAL FURNITURE.
Art Metal Construction Co., Jamestown, N. Y.

METAL LATHING.
G. Hayes, New York.
Truss Metal Lath Co., New York.

METAL SETTINGS (for Glass).
Flanagan & Biedenweg, Chicago.

MINERAL WOOL.
U. S. Mineral Wool Co., New York.

MORTAR COLORS.
Saml. H. French & Co., Phila., Pa.

PAINT.
Joseph Dixon Crucible Co., Jersey City, N. J.
New Jersey Zinc Co., New York.

PHOTOGRAPHS.
J. W. Taylor, Chicago, Ill.

PHOTOGRAPHY (Architectural and Commercial).
Dadmun, Leon E., Boston.

PLASTER ORNAMENTS.
Samuel H. French & Co., Phila., Pa.

PORCELAIN ENAMELED WARE.
Sanitary Standard Mfg. Co., Pittsburgh, Pa.

PUMPS.
Rider-Ericsson Engine Co., New York

RADIATORS.
Shirley Radiator & Foundry Co., Indianapolis, Ind.

RANGE CLOSETS.
Standard Sanitary Mfg. Co., Pittsburgh, Pa.

REFLECTORS.
I. P. Frink, New York.

REINFORCED CONCRETE.
Trussed Concrete Steel Co., Detroit.
"Unit" Concrete Steel Frame Co., Philadelphia, Pa.

ROOFING MATERIALS.
Barrett Mfg. Co., New York.
Blome, R. S., Co., Chicago.
See also Asphalt Roofing.

ROOFING TIN.
American Tin Plate Co., New York.
Taylor Co., N. & G., Philadelphia, Pa.

SASH-CORD.
Samson Cordage Works, Boston.
Silver Lake Co., Boston.

SCHOOLS OF ARCHITECTURE.
Lawrence Scientific School, Harvard University, Cambridge, Mass.
Massachusetts Institute of Technology, Boston.
Ohio State University, Columbus, O.
Pratt Institute, Brooklyn, N. Y.
Society of Beaux-Arts Architects, The, New York.
University of Pennsylvania, Phila., Pa.
Washington University School of Engineering and Architecture, St. Louis, Mo.

SEAMLESS TUBING.
Benedict & Burnham Mfg. Co., Waterbury, Conn.

SHEET-METAL WORK.
W. H. Mullins Co., Salem, O.
J. S. Thorn Co., Phila., Pa.

SHOWERS (Permanent & Portable).
Standard Sanitary Mfg. Co., Pittsburgh, Pa.

SHUTTERS (Steel Rolling).
Kinnear Mfg. Co., The, Columbus, O.

SKYLIGHTS, ETC.
George Hayes, New York.
W. H. Mullins Co., Salem, O.
Vaile & Young, Baltimore, Md.

SKYLIGHT GLASS.
Mississippi Wire Glass Co., New York

STABLE FIXTURES.
Broad Gage Iron Stall & Vase Works, Boston

STAIR TREAD.
American Mason Safety Tread Co., Boston

STEEL ROLLING-DOORS.
Kinnear Mfg. Co., The, Columbus, O.

TERRA-COTTA.
The Northwestern Terra-Cotta Co., Chicago, Ill.

TILES.
Jackson, Wm. H., Co., New York.

TILES (Interlocking Rubber).
N. Y. Belting and Packing Co., Ltd., New York.
Pennsylvania Rubber Co., Jeannette, Pa.

TRAPS.
Cudell, F. E., Cleveland, O.

URINALS (Porcelain Enamelled).
Standard Sanitary Mfg. Co., Pittsburgh, Pa.

VALVES AND PACKING.
Crane Co., Chicago, Ill.
Jenkins Bros., New York.

VARNISH.
Edward Smith & Co., New York.

VENTILATION.
Globe Ventilator Co., Troy, N. Y.
Sturtevant, B. F., Co., Boston.

VIMOMETERS.
Standard Sanitary Mfg. Co., Pittsburgh, Pa.

WATERPROOFING.
Barrett Mfg. Co., New York, N. Y.

WEATHER VANES.
T. W. Jones, New York.

WINDOW LINE.
Samson Cordage Works, Boston.

WIRE GLASS WINDOWS.
George Hayes, New York, N. Y.
Mississippi Wire Glass Co., New York.
James A. Miller & Bro., Chicago, Ill.

ZINC WHITE.
New Jersey Zinc Co., New York.

ROCKEFELLER HALL: BRYN MAWR COLLEGE, BRYN MAWR, PA.

Cope & Stewardson, Architects.

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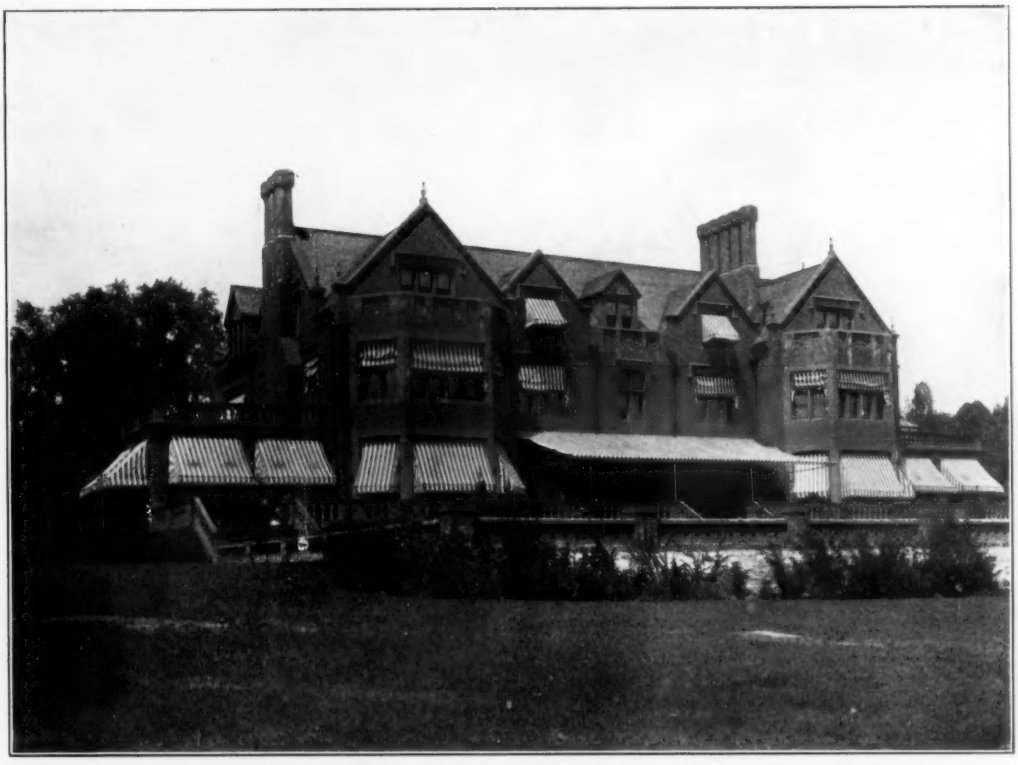
ENTRANCE FRONT.



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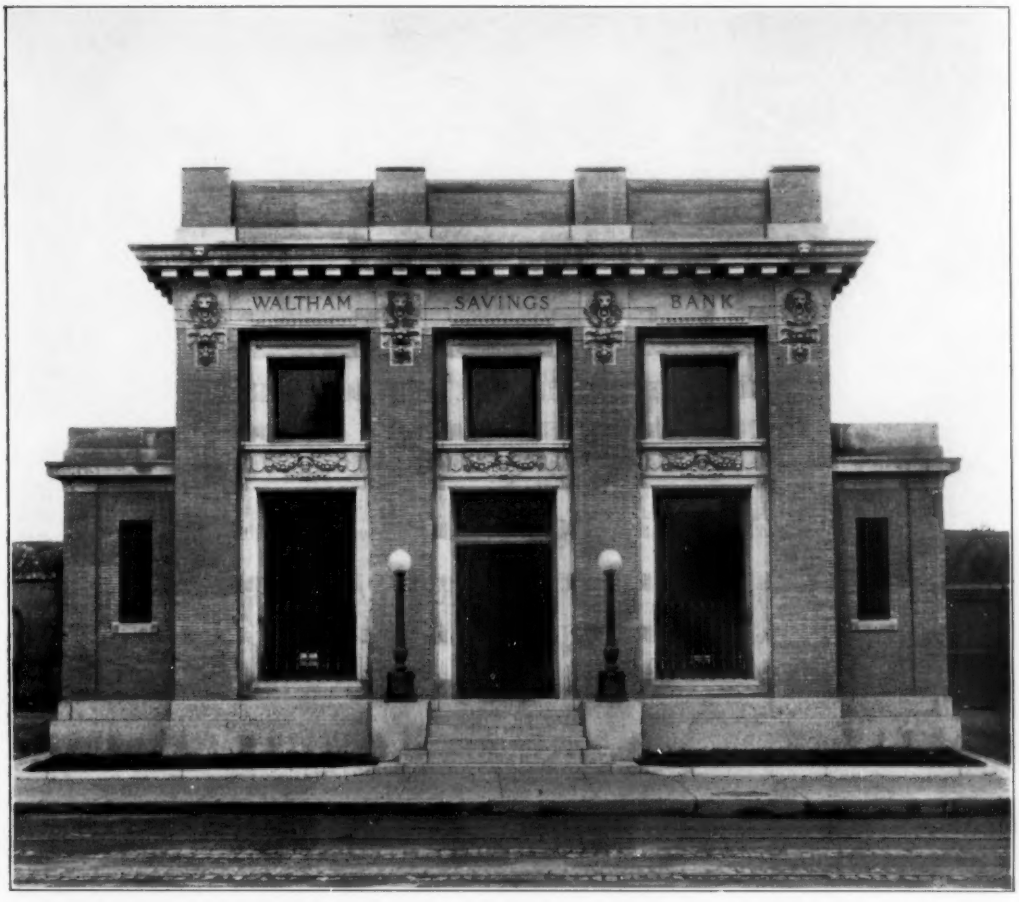

THE WALTHAM SAVINGS BANK, WALTHAM, MASS.

BANK BUILDING, LEOMINSTER, MASS.

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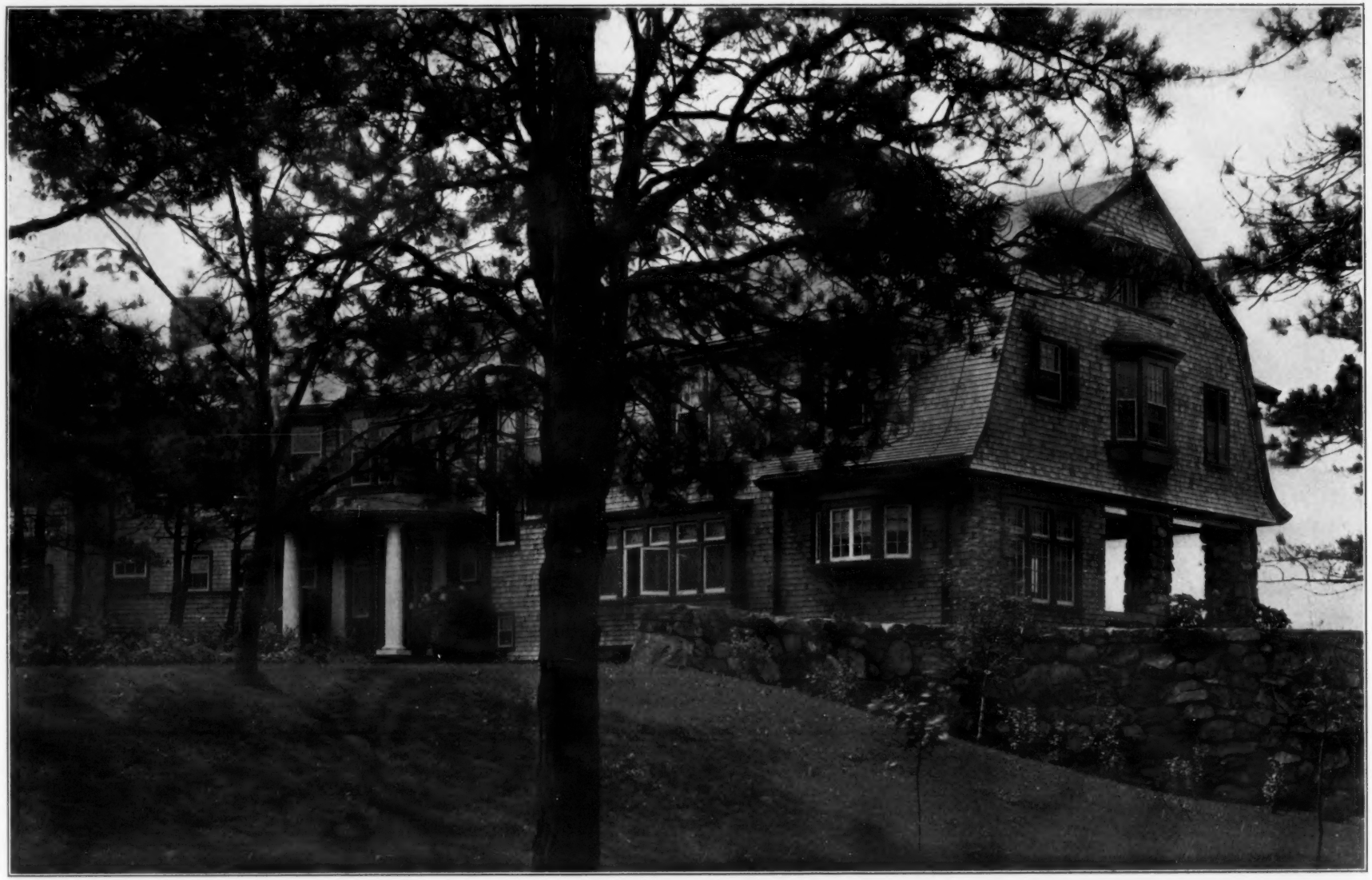

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